# SCIENTIFIC AMERICAN

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WEEKLY.


## THE NEW OCEAN STEAMERS ST. LOUIS AND ST. PAUL.

The necessity for the immediate encouragement for the building, by American citizens, of a fleet of ocean steamships, capable of the highest speed, and constructed with special reference to government naval service, in case of war, led the Congress of the United States, in 1892, to enact certain special laws upon the subject.

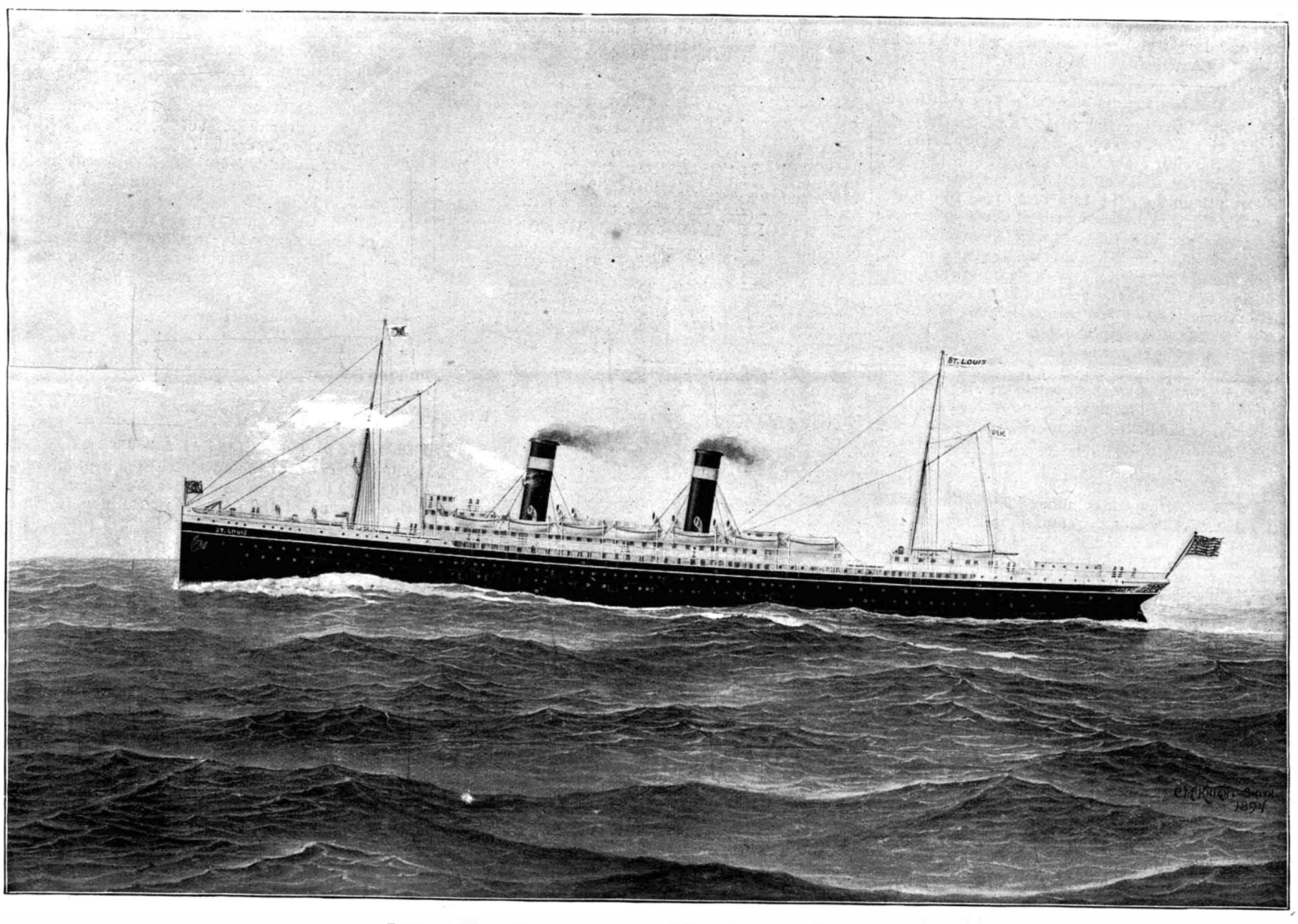
Authority was given to the International Navigation Company, of Philadelphia, at once to place under the American flag two of its fast English-built vessels, the New York and the Paris, provided others of equal or higher class should be promptly constructed in this country.

Thereupon the company entered into contracts with the Messrs. Cramp, of Philadelphia, for the construction of several new vessels, which are now under construction.

The first two of these, the St. Louis and the St. Paul, are now approaching completion. Herewith we present a drawing of one of these vessels, the St. Louis. The following particulars we derive from the *Steamship:*

The St. Louis and St. Paul are the first transatlantic passenger steamers to be built in the United States for a period of over twenty years, and they will be compared with the most recent productions of British shipbuilders, which represent the culmination of their skill and experience. They are the largest vessels ever constructed in America, their principal dimensions being: Length over all, 554 feet; length on load water line, 536 feet; extreme breadth, 63 feet; moulded depth, 42 feet; tonnage, gross register, 11,000 tons. The hull of each vessel is to have a double bottom constructed on the cellular principle, subdivided by athwartship bulkheads and a longitudinal division arranged for heeling purposes, the whole to be available for water ballast. In designing these vessels special attention has been given to the question of safety under all conditions. They are so subdivided by transverse bulkheads that even in the event of a collision and injury to a bulkhead, whereby two compartments might fill with water, the ship would still float in perfect safety. They will have a straight stem and elliptical stern, topgallant forecastle and poop, with close bulwarks fore and aft, two pole masts, and two lofty smoke pipes or funnels. There will be promenade, saloon, upper, main, and orlop decks, the three first-named to be plated from end to end. The main deck will be plated for the length of the machinery spaces, and will have stringers and tie plates beyond. Wood planking will be laid on all decks. The promenade deck will remain unbroken the whole length of the vessel. Arrangements have been made in each of the vessels for carrying about 320 first-class and 200 second-class passengers, and 900 emigrants. The first-class passengers will occupy the center of the vessel, the second class will be between the stern and the center, and emigrants will occupy the ends of the vessel. The main saloon, which is large enough to seat all the first-class passengers at once, will be on the upper deck forward, and will be arranged with a large dome in the middle, so that the appearance of the interior will be that of an immense hotel dining hall. The second-class saloon will also be on the upper deck, but toward the after end, and will be fitted up in the ordinary style of a first-class saloon on an Atlantic liner. The first-class smoking room will be on the promenade deck aft, and will be furnished with everything that experience has taught contributes to the comfort of the passengers. Besides these there will be a library and drawing room, where the ladies and non-smokers may amuse themselves.

The engines of the new steamers will be the most powerful quadruple expansion marine engines in the world. They will probably develop about 10,000 I.HP. each. The cylinders will be 36, 50, 71 and 100 inches respectively in diameter, with a piston stroke of 60 inches, two sets of engines being placed in each boat to turn the twin screws, which will be sectional with three blades. Steam for the working of the main engines will be furnished at about 200 pounds pressure by six steel double-ended boilers, each 20 feet long and 15 feet 7½ inches diameter; the battery to have 48 Purves furnaces 39 inches diameter, and to be fitted with Serve's patent tubes. The total grate surface will aggregate about 830 square feet and the heating surface about 30,000 square feet. Piston valves will be fitted throughout and operated in the usual manner. The crank shafts, eccentric straps and connecting rods will be of forged steel, and the piston rods will be of ingot steel. The valve gear will be of the link type, controlled by a steam cylinder and also by an auxiliary hand gear. Many features will be added to insure the perfect working of these engines. The columns will be of cast steel forked at bottom. The thrust blocks will be of the usual horseshoe type, and the thrust shafts are to be about 13 feet long. The line shafting will be of forged steel, the bearings being of cast iron. The air pumps will be attached, but the condensers will be independent. To support the outboard shaft bearings, the hull is built out in a horizontal web to a steel frame, having both bosses cast in one piece, and weighing about 68,000 pounds. The after deadwood is cut away, and the keel slopes up, so that the shoe meets the boss frame at the after end. To comply with the terms of the contract, the builders will have to show, by an extended sea trial, that when working under ordinary sea-going conditions the vessels are to be easily capable of maintaining a speed of 20 knots




THE NEW AMERICAN ATLANTIC LINER ST LOUIS.

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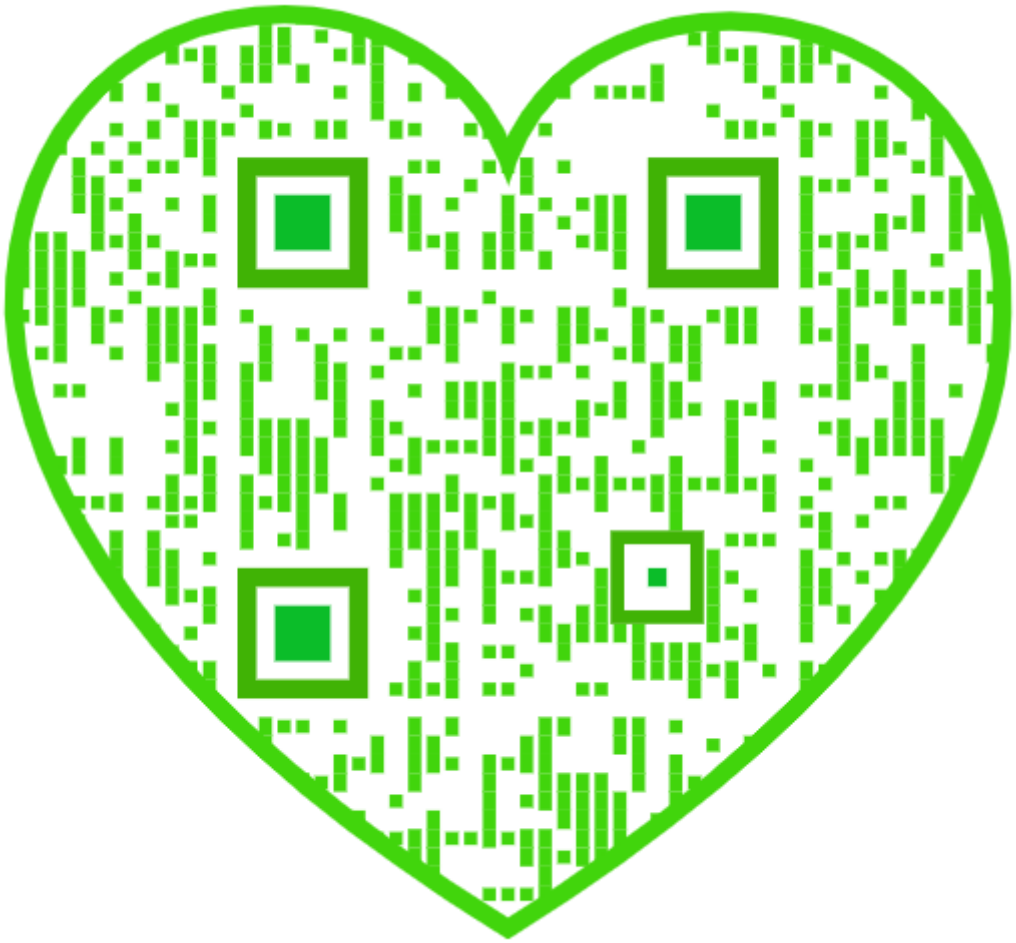

per hour at sea. Of course, the quadruple expansion engines of these twin screw vessels will be the most interesting feature, on account of the great power they are expected to develop.

This is the first time an effort has been made to use quadruple expansion in engines of over 4,000 I. H. P., and in only one or two instances has it been applied to engines of that power. In speaking of the vessels, Mr. Charles H. Cramp, in a paper read before the American Society of Naval Architects and Marine Engineers, said: "I will not venture prediction as to their probable performance, but I will guarantee them to be perfectly safe, comfortable and economical ships. They are to be closely followed by other ships, which I will not now describe, except to say that they will not shrink from comparison or competition. The St. Louis and St. Paul have been especially arranged so as to be readily and quickly convertible into armed cruisers, carrying eight 6 inch 100 pound rapid-fire guns, and the conditions of the mail contract between the United States government and the International Navigation Company place at the disposal of the American navy these great ships, almost instantly convertible into commerce destroyers, averaging greater performance than the Columbia, which, with the three others that are about to follow as quickly as the plans can be completed, will practically re-enforce the United States navy by $21,000,000 worth of ships, and that not only without cost of building, but also without the expense of maintenance and commission in time of peace. In conclusion, allow me to say that these ships will be American from truck to keelson. No foreign materials enter into their construction. They are of American model and design, of American material, and are being built by American skill and muscle."

### Effect of the Earthquake Shock in Constantinople.

Mr. W. S. M'Gregor, the engineer of the Imperial Ottoman Gas Work at Dolma-Baghtche, sends the following to the *Journal of Gas Lighting:*

"A very severe shock of earthquake was experienced in Constantinople on the 10th of July, at 20 minutes past 12 P. M. The first shock lasted about 40 seconds; and a second shock, less severe, was felt about 5 minutes afterward. Considerable damage was done to property, and a number of houses were thrown down; while fires of a serious character broke out in different parts of the city. But comparatively little loss of life took place. At the Imperial Gas Works, at Dolma-Baghtche, the water in the gasholder tanks suddenly overflowed; while in No. 1 holder (a two-lift telescopic holder of 320,000 cubic feet capacity) the water rose suddenly and overflowed the tank, and as suddenly subsided. As the holder was cupped scarcely a sheet in the second lift, it uncupped and cupped again with startling rapidity; the girders and tie rods meanwhile shaking violently, and appearing as if they would be wrenched away from the columns. The chimney stalk of the old works was badly cracked, and a portion of the top thrown down; but beycnd this, and the flooding of the inlet and outlet pipes of the different gas holders, no serious damage was done. Various ugly cracks about the buildings testify to the serious nature of the shock; and altogether, if possible, it is not an experience that one would care to undergo a second time."

### Electric Mail Cars in Brooklyn, N. Y.

The Atlantic Avenue Railway Company has recently completed at its shops, Twenty-fourth Street near Fifth Avenue, an electric postal car designed by the company officials, assisted by the postal authorities of Brooklyn, patterned after the standard type of postal car used on steam railroad lines.

Only half of the car will be used for postal purposes, the other half being a smoking compartment. There are pigeonholes for distributing the mails, and hooks for holding the mail pouches open. Drop letter boxes are provided at each corner of this compartment.

The exterior of the car presents a very handsome appearance. It is painted white, like the United States mail cars which are run on steam routes, the smoking compartment being lettered "Smoking Car." The windows are covered with wire screens. The car is mounted on a Brownell truck.

Two of these cars will go into service immediately.

### An Improved Alloy.

Fifty parts of copper, forty parts of zinc, and aluminum in the proportion of two and a half per cent of the whole are taken. This is one example, but others may be obtained by varying the amounts of copper and zinc to the same proportion of aluminum.

The mode of preparation of the alloy varies: For a hard metal, the copper and aluminum are first mixed to form a copper alloy and the zinc added in small pieces during continuous agitation of the molten mass.

This gives a reddish alloy that takes a high polish. For a ductile metal the zinc and aluminum are first mixed and the copper then added. This gives an alloy resembling brass. In both cases the metal is claimed to be non-oxidizable, proof against sea water, and, to a large extent, against acids.—*D. W. Sugg, London.*


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### THE BROOKLYN MEETING OF THE AMERICAN ASSOCIATION.

As an especial degree of interest belongs to the buildings in whose halls the American Association for the Advancement of Science is to meet next week, a brief description of them may interest the public. The opening general session and the opening sessions of the sections will be held in the Polytechnic Institute of Brooklyn, located on Livingston Street. The building is very ample and of modern construction, fully equipped for the scientific instruction of the thousand or more undergraduates who are pursuing the several courses required for the degrees of Bachelor of Science, Bachelor of Arts, or Civil Engineer, or Electrical Engineer. Alongside this main building is the Preparatory Department, which has about eight hundred pupils in attendance. This institute, indeed, was originally founded, in 1854, as an academy; but its curriculum has been steadily enlarged and extended to meet the increasing demands of a growing city, and larger buildings were required for the accommodation of the increasing number of students. Accordingly, in 1889-90, the Regents of the New York University granted an absolute charter for the Polytechnic Institute, as it now exists, with a munificent endowment and a superior faculty ready for all the higher educational work found in similar institutions elsewhere. While mathematics, the ancient and modern languages, history, philosophy, etc., receive due attention, especial facilities are afforded for the study of chemistry, electricity, engineering, architecture, the steam engine, and the natural sciences in general. The Spicer Library contains 3,000 volumes classified for special investigation and research. The gymnasium is remarkably well equipped, and the laboratories, observatory, art studio and museum of natural sciences are equal to the needs of this admirable institution. And all these rooms and their contents are for the time at the disposal of the A. A. A. S. by the generosity of the corporation.

The Packer Institute is located on the corner of Livingstone and Joralemon Streets, in ample grounds, with spacious lecture rooms, fine laboratories, libraries and scientific collections. This college is for young ladies, of whom nearly 1,000 are in attendance during term time. Its graduates enter the senior year of such colleges as Smith and Vassar. The building being near that of the Polytechnic Institute, some of the sections will be assigned to rooms here.

The evening addresses, receptions and closing session will be held in the Academy of Music and Art building, Montague Street. All these buildings are near each other and are within a block of the City Hall Square.

### THE WASTE OF COAL MINES AS A SOURCE OF POWER.

The readers of our columns have been kept informed of the work in progress at Niagara Falls for the utilization of some of the power now running to waste over the great precipice. Recently the project has been attacked by our contemporary, *Electricity*, and the assertion has been made that there is little chance of its paying for some time to come, and that it has a dangerous rival in the culm heaps of the Pennsylvania coal regions. Every coal mine in the anthracite region produces enormous quantities of coal dust, known as culm, which keeps on accumulating, as it has accumulated for many years, about the mines and coal breakers. This culm has good, calorific value, and recently manufacturers have begun to use it under their boilers. It can be bought for twenty-five cents a ton. Mr. D. B. Atherton, the secretary of the Scranton Board of Trade, has given figures to show that with culm firing a horse power per annum will cost but $3.93. At Niagara Falls a horse power will cost, it is said, $15 per annum. It is evident that the culm bank is the cheaper.

Of course this apparent difference is offset by other considerations. No account is taken of the capitalization of the steam and electric plants required to utilize culm, but the difference in the quotations given is so great as to certainly give the economic advantage to culm as a source of energy. In utilizing culm we are disposing of a waste product and of an accumulation of man's operations. In burning coal we are disposing of the accumulation of Nature's riches. Natural gas is already on the wane, and sooner or later coal will become exhausted. Then will be the time for Niagara Falls and similar natural sources of power to do their part in the work of the world. But to-day there is at least a suspicion that the heavy capitalization of the Niagara Falls works will restrict greatly its domain of usefulness.

Another point made is that the anthracite regions are more favorably situated for the distribution of power than are Niagara Falls. On the whole, a very strong plea has been made for the culm bank as opposed to the great cataract.

Repeatedly in modern industries the question of capitalization has determined the success or failure of enterprises. At Niagara Falls the power primarily costs nothing; the capitalization and harnessing of the force of the cataract constitute the elements of cost.

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### The Growth of Cities.

The comparative growth of American and foreign cities is one of particular interest to the American, to whom the increasing size of American cities is a matter of great pride. It appears, however, that according to statistics the growth of great foreign cities has been even more rapid than our own. In a recent number of the *New Review*, Mr. Stead makes the assertion that the growth of Chicago is by no means as remarkable as the growth of London; while Dr. Shaw, in the *Century*, gives some interesting comparisons which have been epitomized by the *Sun*. "Beginning," it says, "with the capital of the German Empire, Mr. Shaw points out that in 1860 it was smaller than Philadelphia; since then it has added a million to its population, while Philadelphia has added but half a million. In 1870 Berlin had considerably fewer inhabitants than New York, the figures being 800,000 against 950,000. In 1890, according to the official enumerators, Berlin had 1,578,794 inhabitants, against 1,515,301 in New York. Passing to the German city next in size, we find that in 1875 Hamburg had only 263,540 people, whereas Boston had 342,000. In 1890 Hamburg had 569,260, while Boston had but 448,000. Again, in the early seventies Hamburg and Baltimore were of equal size; in 1890 the German city had beaten its American rival by more than 134,000. The third German city in respect of population is Leipsic, which has grown from 127,000 in 1875 to 355,000 in 1890, having considerably distanced San Francisco, which was the larger in the year first named. In the same period Munich and Breslau have both beaten Cincinnati. Among the gains which we are wont to think remarkable during the decade from 1880 to 1890 may be mentioned that of Cleveland, from 160,000 to 261,000; that of Buffalo, from 155,000 to 255,600; and that of Pittsburg, from 156,000 to 238,600.

All of these were surpassed by Cologne, which in the same time increased from 144,800 to 281,800. The comparison is carried out by Mr. Shaw in great detail, and might have been pushed even further with substantially equivalent results. We cite a few more notable examples of progress on the part of German cities. In 1880 Dresden had 220,000 inhabitants and New Orleans 216,000; ten years later the former had grown to 276,000, while the latter could show but 242,000. Between 1880 and 1890 Louisville advanced from 123.758 to 161,129; in the same decade Hanover had risen from 122,800 to 163,600, and Konigsberg from 122,600 to 161,500. It is fair to say that meanwhile Jersey City had slightly outstripped the two German towns, having increased from 120,722 to 163,003. In the decade mentioned, Frankfort-on the-Main and Newark were almost neck and neck, having started with 136,800 and 136,500 respectively, and having finished with 180,000 and 181,800. We are accustomed to regard Minneapolis and St. Paul as astonishing instances of growth, yet between 1885 and 1890 both were outdone by Magdeburg. Even Chemnitz beat St. Paul, having had 110,800 against 111,000 in 1885, and having attained in 1890 to 138,955 to St. Paul's 133,156. The area, however, of many German cities would be considered small according to the present American standard. Thus Berlin, Hamburg, Leipsic, and Munich, the four largest cities of Germauy, cover each a superficies of only about 15,000 acres. Viewed as a whole, the comparative statistics of the two countries sustain Mr. Shaw's conclusion that, since the war of 1870, the urban centers of Germany have been gaining population even more rapidly than those of the United States.—*Literary Digest.*

### Importance of Slow Burning Construction for Buildings.

The August number of the Engineering Magazine contains an excellent article by Mr. Edward Atkinson, on the enormous losses by fire, the results of ignorance, stupidity and neglect. He says:

There are no more perfect examples of the art of combustible architecture than are to be found in most of the hospitals, asylums, college buildings and school houses. He has never been called upon to inspect more dangerous and unsuitable buildings than some of the larger hospitals, especially one for the insane, which he was once asked to protect as far as he could. The power of invention had been exhausted in making that building unsafe and unfit for its use, and that has been the common rule rather than the exception down to a very recent period. He does not insist upon an absolute fireproof construction of all buildings, as that would be impracticable, owing to the heavy costs; but he strongly advocates a better use of ordinary building materials, whereby the fire cannot so rapidly spread, thus giving time for extinguishment.

For instance, wherever the mill floor, suitably constructed of three inch plank, grooved and splined, covered with one inch top boarding, laid on timbers eight or ten feet on centers, has been made continuous—that is to say, without any break for belt holes, open elevators, or open stairways—it has never been burned through by a fire upon the floor or by fire passing through the floor above, except in one instance, and that was in a warehouse where a pile of jute bales took fire in a place where it could not be reached. The firemen then put water through the hole from open butts and drowned it out. Fires on such mill floors have been held, not only in the building, but in the room where they originated.

Again, iron posts have been crippled or sprung by heat a great many times at an early period in a fire. A wooden post of suitable size has never burned off until other parts of the building were already destroyed. They have in one instance resisted for hours fire which destroyed granite posts near them by reducing them to sand—the granite measuring 12 by 12 inches. In this instance oak posts were put in between the original posts of granite to bear an added weight of machinery. When the fire came, the oak sustained the whole load.

To repeat, the mill floor properly constructed and rightly guarded has sufficed to hold fires not only in the building but in the room in which they have originated, until the mill fire department or the public fire department could extinguish the fire. The wooden mill post of suitable size will last longer than the floor. The mill floor possesses this very great advantage over the ordinary joisted floor; fires may be readily swept away between the timbers either by sprinklers or by water from hose pipes; while in the joisted floor or floor laid over plank on edge 18 inches to 24 inches apart on centers, the fire will burn on one side of the joist or plank while the water is playing on the other side.

WHAT MILL CONSTRUCTION IS.

I. Mill construction consists in so disposing the timber and plank in heavy solid masses as to expose the smallest number of corners or ignitable projections to fire, to the end also that when fire occurs it may be most readily reached by water from sprinklers or hose.

II. It consists in separating every floor from every other floor by incombustible stops—by automatic hatchways, by incasing stairways either in brick or other incombustible partitions—to the end that a fire shall be retarded in passing from floor to floor to the utmost that is consistent with the use of wood or any material in construction that is not absolutely fireproof.

III. It consists in guarding the ceilings over all specially hazardous stock or processes with plastering laid on wire lath or upon dovetailed lath or by plaster board of a suitable kind, following the lines of the ceiling and of the timbers without any interspaces between the plastering and the wood; or else in protecting ceilings over hazardous places with tin or other suitable metal, but not with zinc.

IV. It consists not only in so constructing the mill, workshop, or warehouse that fire shall pass as slowly as possible from one part of the building to another, but also in providing all suitable safeguards against fire.

V. It consists in laying the top floor and the outer boarding of the roof over mortar, plaster board, or some other fire retardent between it and the plank, where the maximum of safety is to be attained.

WHAT MILL CONSTRUCTION IS NOT.

I. Mill construction does not consist in disposing a given quantity of materials so that the whole interior of a building becomes a series of wooden cells; being filled with concealed spaces, either directly connected each with the other or by cracks through which fire may freely pass where it cannot be reached by water, That is the common practice now named "combustible architecture."

II. It does not consist in an open timber construction of floors and roof resembling mill construction, but of light and insufficient size in timbers and thin planks, without fire stops or fire guards from floor to floor.

III. It does not consist in connecting floor with floor by combustible wooden stairways incased in wood.

IV. It does not consist in putting in very numerous divisions or partitions of light wood.

V. It does not consist is sheathing brick walls with wood, especially when the wood is set off from the wall by furring, even if there are stops behind the furring.

VI. It does not consist in permitting the use of varnish upon wood work over which a fire will pass with the speed of a race horse.

VII. It does not consist in leaving windows exposed to adjacent buildings unguarded by fire shutters.

VIII. It does not consist in permitting the storage of very combustible goods without protecting the ceilings with solid plastering, plaster board, or metal.

IX. It does not consist in leaving even the best constructed building in which dangerous occupations are followed without automatic sprinklers and without a complete and adequate equipment of pumps, pipes, and hydrants.

X. It does not consist in using any more wood in finishing the building after the floors and roof are laid than is absolutely necessary, there being now many safe methods available at low cost for finishing walls and constructing partitions with slow burning or incombustible material.

The importance of these suggestions will be understood if we reflect for a moment upon the vast aggregate of property values annually destroyed by fire. Mr. Atkinson says:

The waste of property by fire is increasing year by year, in undue proportion to the increase of property at risk. Last year's ash heap in the United States has been computed in excess of $150,000,000. In order to ascertain the true measure of the fire tax we must add to this some $60,000,000 to $70,000,000 as the cost of sustaining insurance companies, by which a part of the loss is distributed throughout the community. To this again must be added the cost of sustaining fire departments, which came to $25,000,000 some years ago, when I first investigated this subject. Thus the measure of this fire tax in the past year cannot have been less than $250,000,000. That is the penalty which we pay for ignorance, stupidity, carelessness, and crime, for which the responsibility must be distributed mainly among owners of buildings, though shared in part by occupants, architects, and builders.

### The Padrone Robbers.

The merciless exactions of the Italian padrones in our large cities, and some of the efforts now being made in Boston to suppress them, are described by Dr. Edward Everett Hale in *Lend a Hand* for June:

"The word 'boss' is none too honorable in its broader sense, but the boss of a working party who are taking up the streets may be a Christian gentleman of the type of Sidney. These Italian bosses have none of his duties. They are not the foremen who preside over the workmen or give them their directions; they are simply an avowed class of middlemen, whose intention it is to make as much money, on the one hand, from the contractors for labor, and, on the other hand, from the laborers, as they can squeeze out of either party.

"They do this in this way: They say to the laboring man, 'You must give me a bonus for finding work for you.' This bonus ranges from two to six dollars. They say, in the second place, 'When I have found work for you, you must live in certain tenements which I shall provide for you.' These tenements are of the lowest grade, while the rent is such as belongs to much more comfortable apartments. They say, in just the same way, 'You must buy your food at my shops;' the food also is of the lowest grade, and the price is much more than it is worth. The laborer is thus bound to the boss by all the ties by which, in the lowest regions of the South now, the poorest negro is bound to the person from whom he hires his land.

"After this miserable arrangement has been made, the boss, at his convenience, agrees with some contractor that he will furnish ten, twenty or forty workmen, and he does so. Very probably the contractor pays him $1.75 a day for the workmen, of which he pays to the workmen $1.50. The workman cannot help himself, and has to take what he can get. More likely, at the end of ten or twenty days, the workman is turned off by the boss, who by this time wants to hire other laborers who will pay him a new bonus or entrance fee. The laborer has no remedy against him.

"The so-called boss, having thus got the laborer pretty much in his power, establishes a bank, as he calls it. This is a place where he takes the money which these poor Italians wish to remit to Italy, and provides for them bills of exchange. Nobody knows how much he makes them pay for the exchange; and that is comparatively unimportant when one considers the other result, which is that three of these bankers have, this winter, abandoned the business of banking, and retired to parts unknown, with $90,000 which belonged to these poor people. Thus far legal remedies have been vain; so useless, indeed, that it is said that one of these persons, having apparently spent his share of this plunder, has come back to Boston and is about to attempt a similar enterprise again.

"It is almost inconceivable that such a tissue of fraud should have been woven under our own eyes here, among people who have, at least, the rights of dogs or monkeys if they have not the rights of men."

### Strawberries vs. Gout.

Strawberries have for a long time had a well-established reputation as a remedy for the gout. Dr. A. George, in the *Annales de la Société Horticole de l'Aube*, tells us that in the last century the great botanist Linnæus, who was gouty, had much cause to extol the action of the fruit in this disease. At this epoch, when uric acid was unknown, he had the prescience that the chemical cause of gout was identical with that of gravel, and he expressed himself in a picturesque manner to one of his friends when he wrote to him: "I have the gout and you have the gravel; we have married two sisters." The only method that Linnæus found of easing his gout was by an abundant use of this fruit, to which he has made a graceful acknowledgment in his writings.

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### The Rifle Balls of the Future.

The reduction of the caliber of guns is necessarily accompanied with a diminution in the weight of the projectile. The length of the latter, in fact, cannot exceed a certain limit, beyond which it would no longer have sufficient stability in its trajectory. It would, therefore, be of considerable interest to have at our disposal, for the manufacture of rifle balls, a metal of reasonable price and heavier than lead. One of the metals upon which hopes may be founded, remarks the *Revue d'Armes Portatives et de Tir*, is tungsten. This metal, which is almost as hard as steel, has a density varying from 17 to 19·3, say one and a half times that of lead. By reason of such qualities, balls of tungsten, of equal dimensions, possess a power of penetration much greater than that of lead. Thus, a tungsten ball penetrates a steel plate 3 inches in thickness at a distance of 650 yards, while a similar one of lead penetrates a 2¾ inch plate at 325 yards only. The present obstacle to the use of tungsten is its relatively high price, but there are indications that this will soon be lowered to reasonable figures.

### NEW TOOL SHARPENER.

There is perhaps no better gauge of the ability of an artisan than the appearance of his tools after he has sharpened them.

Mechanics are not common who can sharpen a tool so as to give its smooth plane surfaces a correct angle and a clean edge. Recognizing this fact, Messrs. Ezra F. Bowman & Co., of Lancaster, Pa., have brought out a simple but effective device for holding tools of various kinds while being sharpened. This device, which is shown in the annexed engraving, consists of a yoke in which is journaled a roller designed to roll upon the surface of the stone on which the tool is to be sharpened, a post inserted in the yoke and capable of being adjusted to any desired angle, and a tool-holding clamp inserted in the end of the post and adjustable in a plane at right angles to the plane of rotation of the post. It will thus be seen that the tool may be readily adjusted to form any angle with the abrading surface. The milled nuts serve to clamp the parts in any desired position.

GRAVER, DRILL AND TOOL SHARPENER.

The collar on the tool clamp and the base of the post are graduated to permit of reproducing any particular adjustment

While this tool is more especially designed for sharpening jewelers' and engravers' tools, it is applicable to other uses.

It is particularly useful in sharpening gravers of various kinds, flat and twist drills, and many other small tools which, without the aid of this instrument, can be sharpened only with considerable difficulty.

### The Phonograph in the Class Room.

Professor McKendrick, of Glasgow University, carried out an interesting experiment in his physiology class one day recently. The occasion was the formal closing of the summer session, and the professor gave a practical demonstration of the ability of the phonograph to deliver the lecture which he had previously spoken into the instrument. The words were distinctly heard in every corner of the class room. Of late, suggests the *Christian Commonwealth*, such "demonstrations" on the part of noisy students have occurred and recurred in certain of the medical classes in the university that the suggestion to substitute the phonograph for the *personnel* of the lecturer may not seem altogether far fetched.

"HELLO! What do you want!" exclaimed a parrot the other day, when a robber entered an apartment house up town. The thief had adroitly seized some clothing and was making off with it when the voice of the bird called the occupant's attention to the intruder, who was quickly arrested and taken to the police station.

### Punches.

A large number of tests of punches of different forms were recently made by Mr. George S. Allen. The object of the experiments was to determine: (1) Which of the various shaped punches now in common use for punching iron and steel did its work with the least maximum pressure and the relation of unit stress to distortion as the punch passed through the plate; (2) the effect of clearance upon the power required by the punch; and (3) the effect of the form of punch and the amount of clearance upon the tensile strength of the punched plate. The results of the test may be summarized as follows:

1. A punch to work easily and not injure the metal should not be cupped out.

2. A double punch, that is, one which first punches a small hole and then reams it out by means of a shearing counter-punch, leaves the plate stronger, but requires at least twice the power necessary to run a flat punch.

3. The ordinary flat punch leaves the plate about 90 per cent as strong as a drilled and reamed plate.

4. A milled spiral punch is preferable to one which has the spiral cut in a lathe.

5. A single spiral requires less pressure than a double one, and leaves the metal about as strong.

6. A single sloping or whistle-shaped punch does its work with the least consumption of energy.

7. Between the limits of 0·01 inch and 0·05 inch clearance has no effect on the power consumed by a punch or upon the strength of the punched plate.—*Engineering.*

### Tests of Bullet-Proof Clothing.

An example of bullet-proof clothing, claimed to be equal to that of the famous German inventor, Herr Lowe, has been produced in this country. John F. Lennard is the inventor. An exhibition was recently given at the Imperial Music Hall, this city. Marksman Johnstone took his place on a platform in the center of the auditorium and fired at a corrugated steel plate with a Winchester rifle. Sixteen boards seven-eighths of an inch in thickness nailed together, with a seven-eighths of an inch space between each, were then placed before the steel plate. Two shots fired traversed the fourteen inches of pine wood and struck the plate.

Lennard, the inventor, then donned his bullet-proof shield, concave in shape. It covered less than a foot and a half square of his chest. With chalk a small bull's eye was made in the center. Johnstone aimed, and at the command of fire, given by Lennard, he discharged his rifle. Lennard trembled visibly as the bullet struck, but he was unhurt. As represented the act is certainly a remarkable one. Lennard declines to divulge the secret of his fabric. He asserts that, unlike Maxim's, there are no steel plates concealed in the shields, proof of which he will furnish by permitting their being tested by means of a brace and bit.

### How to Make Milk Sugar.

Prof. C. L. Penny, of the Delaware Experiment Station, gives the following:

The skim milk is heated in a suitable wooden or tin tank to about 120 deg. F. To this, for each 100 pounds of milk, one and one-half pounds of sulphate of alumina is added in the form of a hot solution. The curd precipitates at once or in a very few minutes. The clear whey is then separated from the curd by filtering through wire gauze. It is next heated to not less than 180 deg. and about one-fourth pound of powdered chalk to each 100 pounds of milk is added. The excess of sulphate of alumina is precipitated, together with some nitrogenous matter in the whey not precipitated by the first treatment. From this precipitate a perfectly clear filtrate may be obtained, the large part by simply drawing off, the last portion by filtering through duck filters. This clear juice contains sugar, some sulphate of lime, and still a small residue of nitrogenous matter. . . . To prevent foaming, which would greatly retard the work or cause a loss of much of the sugar, a treatment with ground oak bark, or its extract, has been found thoroughly effective.

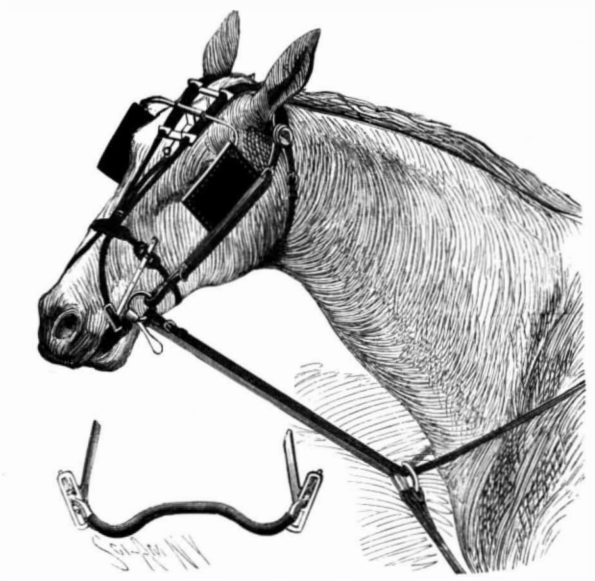
It is indeed believed to be, if not a necessary part of the process, at least one that will greatly facilitate it and diminish the loss. From three to four pounds of ground bark for every 100 pounds of milk is found to be enough. Instead of the ground bark, from two-fifths to one-half pound of commercial tanner's extract of oak bark is more convenient and equally sufficient. Bone-black also attains the same end, but it is not recommended on account of the time, trouble and expense of the treatment. The whey thus purified is boiled in a vacuum pan just as are sugar juices. The crude, almost black product is first boiled to prevent moulding and afterward purified by being redissolved, passed hot over bone-black till it is colorless, and again evaporated to the point of crystallization. The purified sugar must be dry to prevent moulding.

It is estimated that with this method about 65 per cent of the refined milk sugar in skim milk, or about 3¼ pounds of commercial milk sugar per 100 pounds of skim milk, can be recovered at a cost of about 13 cents per pound, which might be reduced with experience. The price of milk sugar during the year (1891) is quoted at 24 cents. The profit from working 5,000 pounds of skim milk per day, with milk sugar at 20 cents per pound, is calculated at $21.09; and with sugar at 15 cents, $12.96.

It is also believed that with actual experience the yield could be increased and the cost diminished from the figures given above, which are intended for the simplest form of plant, just such as is actually necessary to the profitable conduct of the business on a fairly large scale. The estimates are intended to be entirely safe and to overrate the expense and underrate the profit, rather than the reverse.—*Rural Pacific.*

### AN IMPROVED CHECK REIN SUPPORT.

The combined check rein support and winker stay shown in the illustration has been patented by Mr. Joseph Carter, of Blyth, Ontario, Canada, the overcheck bit being also shown by itself under the horse's head. This support for an overdraw check is designed to prevent the check rein from wearing or rubbing against the head of the horse, and the winker stay is so attached that the blinds or winkers may be readily adjusted at any desired angle to the animal's head. The support consists of a face cross bar of leather, or metal and leather, having felt on its inner side, and resting on the animal's face, where it is held by means of two side bars, preferably of spring steel, leather covered. The bars are curved so as not to touch the animal's face, and their upper ends are attached to the crown strap of the bridle, which may also be of felt or similar material on its under side. There are loops or sockets, each with friction rollers, on the side bars, through which pass the rearwardly extending members of the overdraw check, rendering it very sensitive to every movement of the horse's head. The winker stay consists of a rod with a shank adjustable by a set screw in a slideway in the central portion of the face bar, the rod having in its ends sockets in which the wires constituting the frames of the winkers are conveniently adjustable.



CARTER'S CHECK REIN SUPPORT.

### Explosion of a Silvering Mixture.

Sanderson Drury, a youth of 18, was nearly blinded recently by the explosion of a mixture of nitric acid and mercury. Drury had a brass watch chain, and he was anxious to turn it into silver. He learnt the secret how to do this from one of the itinerant lecturers who attend Shipley Market, and he paid a visit to a chemist and purchased a mixture of nitric acid and mercury, which was supplied to him in a bottle. He had not gone far from the shop when the bottle was blown to pieces, the glass and the acid striking Drury in the face. At first it was thought by bystanders that the youth was killed. They conveyed him to the hospital, where Dr. Foster found that there were serious injuries to the eyes and face. The usual remedies were applied and the patient is going on as well as can be expected, although he has not yet regained his eyesight.—*Yorkshire Evening Post.*

### Artificial Silk.

The process of producing "artificial silk," invented by Dr. Lehner, was shown to a party of scientists, etc., at Bradford recently. Waste cotton, wool, jute, or other suitable material is reduced to an emulsion by means of a mixture of nitric and sulphuric acids, when it is formed into threads by forcing it through glass tubes of small bore, and is passed over a series of rollers and wound in the ordinary way on bobbins. Before the artificial silk is used in manufactures, or is sold, it is denitrated to destroy the explosive properties, and is also rendered uninflammable, which will render it suitable for many purposes, especially as it is said to resemble real silk very closely.

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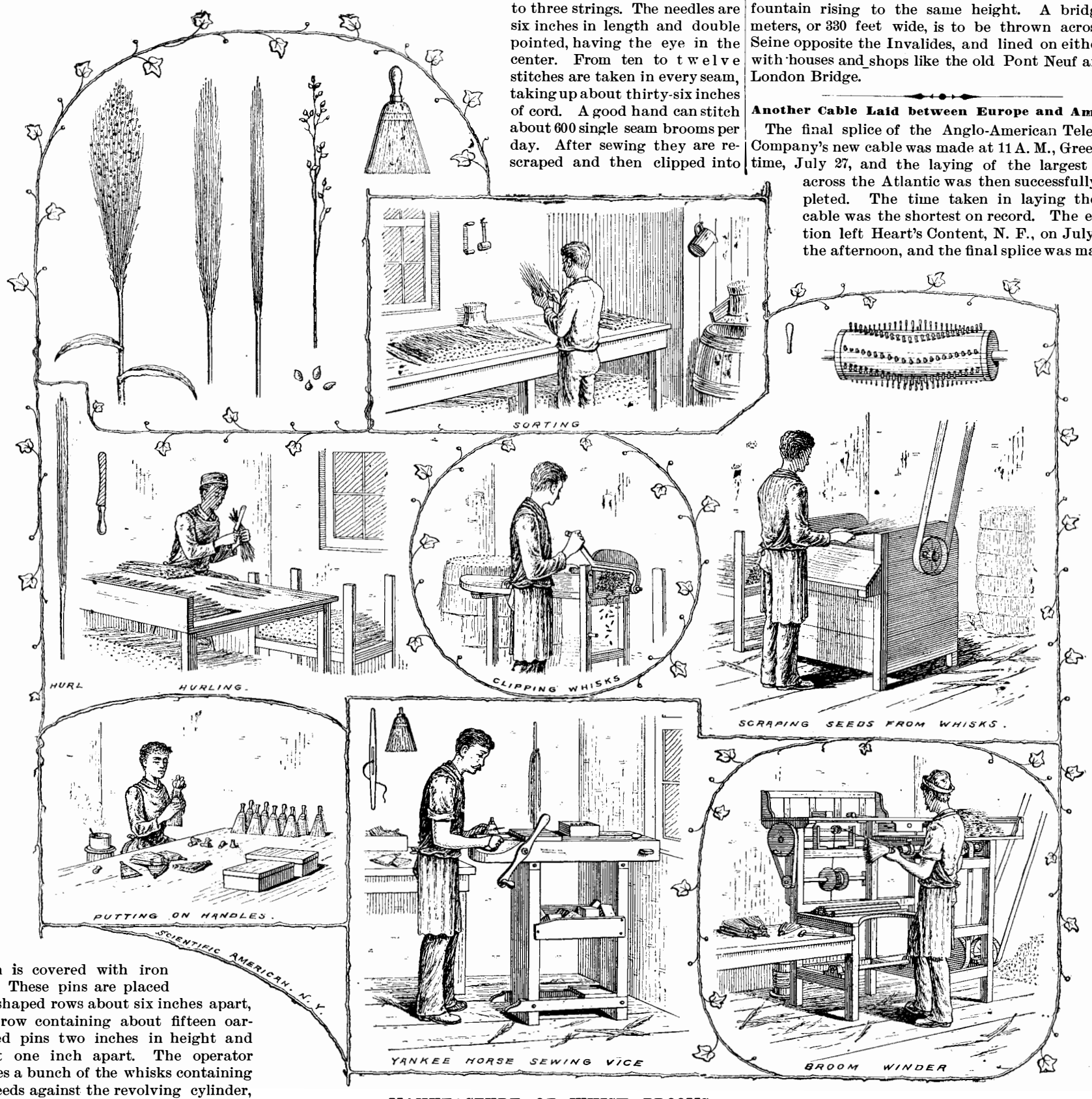
### MANUFACTURE OF WHISK BROOMS.

Broom corn, from which brooms are made, comes principally from the Western States. The seeds are sown in May or June, about one foot apart, in rows. In about three months' time the stalk reaches to the height of from eight to twelve feet; the top ends, which contain the whisks, are then ready for cutting. The stems are first bent over about one foot below the whisks and then cut off and packed into wagons and carted to the barns to be scraped and dried. After drying it is packed into bales weighing from 250 to 400 pounds each and shipped to the broom manufacturers. The first operation is sorting or selecting the stock, the finest and greenest being used for the best brooms. After sorting the material is scraped. The scraper consists of a circular revolving cylinder nineteen inches in length and twelve inches in diameter, the surface of which is covered with iron pins. These pins are placed in V-shaped rows about six inches apart, each row containing about fifteen oar-shaped pins two inches in height and about one inch apart. The operator presses a bunch of the whisks containing the seeds against the revolving cylinder, the teeth of which, traveling at the rate of 350 revolutions per minute, tear through the material, scraping off the seed from the whisks. If the material is old, having lost its green appearance, it is dyed. The stalks are then clipped off and the whisks made of an even length. The best and straight whisks, which is called hurl, grows in the center of the stalks. It is kept separately from the rest and is placed on the outside when forming the brush. The next operation is winding or forming the brooms. A circular piece of wood about three inches in length and about three-quarters of an inch in diameter is fastened into what is called the broom barrel. Connected to the machine is a reel of No. 22 iron wire, the end of which is tacked to the circular stick in the barrel. The operator then takes a quantity of the poorer quality of the whisks and places them around the stick, starting the machine in motion, which causes the barrel to revolve, which, in turn, wraps the wire tightly around the whisks to the stick. After two or three turns of the wire has been taken the shoulder of the broom is then formed by putting a bunch of the material on each side and wiring and tacking them down as before. The hurl is then fastened on the outside in about the same manner. The rough edges are then trimmed with a knife and the broom sawed off from the barrel. A good hand can form about 150 brooms in about ten hours. The brooms are then taken to the sewing vise to be stitched. A broom is fastened securely in the jaws of the vise, the top part projecting above about three inches. The operator then takes a flat oval-shaped steel needle threaded in the center with fine linen cord or silk and passes it through the brush, securing the end. The cord is then wrapped tightly around the outside of the brush and the needle pushed through back and forth, each stitch passing over and under the outside cord, which is drawn taut, securing the whisks and giving shape and form to the broom. Brooms are sewed with from one to three strings. The needles are six inches in length and double pointed, having the eye in the center. From ten to twelve stitches are taken in every seam, taking up about thirty-six inches of cord. A good hand can stitch about 600 single seam brooms per day. After sewing they are re-scraped and then clipped into sizes. The ends are then sheared and curried to free the brooms of surplus seed. The handles, which are made of bone, ivory, wood, etc., are then glued on and the brooms stood up to dry. They are then packed into boxes and are ready for market. Twenty hands can turn out about from 75 to 80 dozen brooms per day. The green stock is the best for broom making, it bringing from five cents to six and one-half cents per pound by the ton wholesale. If too ripe, the color of the material being reddish, the stock loses in value about three cents per pound. The sketches were taken from the plant of F. H. Bookhop, New York City.




MANUFACTURE OF WHISK BROOMS.

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IT is estimated that the yearly passenger trips on ferryboats between New Jersey and New York number 70,000,000; that the total for all New York ferries will exceed 170,000,000; that the number of boat trips equals 1,800,000, and the number of teams carried 5,000,000. This immense traffic is carried on with remarkable safety.

### Paris Exhibition of 1900.

Thirty-six projects for what is called the Clou, or main attraction, of the Paris Exhibition for 1900 have been sent in to the special sub-committee. The well known engineer, M. Armengaud Jeune, proposes the offering of handsome prizes for solutions of the three problems, transmission of sight to a distance, chromophotography on paper, and electric lighting without focus, by cold light with the aid of electric undulations of great frequency. M. Flammarion, the astronomer, proposes a shaft showing the various geological epochs with their inhabitants, and also an arrangement by which the spectator would witness the revolution of the earth as if from the surface of the moon. M. Trouve, the electrician, advocates a luminous cascade falling from the upper platform of the Eiffel Tower and also a luminous fountain rising to the same height. A bridge, 100 meters, or 330 feet wide, is to be thrown across the Seine opposite the Invalides, and lined on either side with houses and shops like the old Pont Neuf and old London Bridge.

### Another Cable Laid between Europe and America.

The final splice of the Anglo-American Telegraph Company's new cable was made at 11 A. M., Greenwich time, July 27, and the laying of the largest cable across the Atlantic was then successfully completed. The time taken in laying the new cable was the shortest on record. The expedition left Heart's Content, N. F., on July 15, in the afternoon, and the final splice was made on the morning of the 27th, or less than twelve days. As the Irish shore end was laid in less than two days, the total time taken was inside of two weeks, a most remarkable achievement when it is considered that this cable is of the heaviest type ever laid.

A curious coincidence in connection with its completion is the fact that the final splice was made on the anniversary of the day on which the first successful cable was landed at Heart's Content in 1866, twenty-eight years ago; and not only the same date, but on the same day of the week.

The new cable is laid between Heart's Content and Valentia, Ireland. This cable has a larger conductor than any cable ever laid. It contains 600 pounds of copper per nautical mile. This increase of copper in the conductor means a proportionate increase in the speed of transmission. The new cable has, therefore, the greatest capacity of all long cables. It is consequently a valuable addition to the telegraph facilities between America and Europe.

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### The Building of a Battleship.

Albert Franklin Matthews describes in an article, "The Evolution of the Battleship," in the July *Century*, the great shipyards of the Cramps, where our monster sea dragons are hatched out. Mr. Matthews says:

THE CRAMP SHIPYARD.

"The Cramp shipyard has nearly a quarter of a mile of water front. Along this frontage are ships in various stages of construction, some on the stocks and some in the water, illustrating almost every step in the building of a vessel. Here, near the entrance to the yard, is an acre or more of punching machines, enormous contrivances that, as they close their jaws, with their ungainly teeth bite out holes for rivets in the plates and frames as easily as a farmer's wife takes out the core of an apple. Over there is a steel checker-board frame into which big pins are set in a curve. Against the pins stalwart sledge swingers, half naked, bend the cherry red frames and plates, as they are slid out of the furnace, into the shapes they must assume for use in the vessels. Here is a great row of blacksmith forges. Over there is a building where a dozen monster boilers are in construction, and where a traveling crane lifts and moves them as easily as a hotel porter does big trunks. Here are big ship engines, some set up and some taken down. Here are foundries where manganese bronze screws are cast, and where brass and iron are fashioned into a thousand forms. Here is the great mould loft where every line in the ship is laid down, and from which wooden counterparts of the vessels are made before the steel construction begins. Here are the wood-working shops, the gun factory, the great store house, and there is the floating derrick that can pick up a seventy ton boiler, move it 300 feet, lift it high in the air, and place it in a ship in thirty minutes, with as careful an adjustment as a watchmaker uses in fitting a movement in its place. And here are 5,000 men employed in various capacities — machinists, woodworkers, moulders, and perhaps most noticeable of all, riveters in sets of three, one man to hold a big sledge against the red hot rivet, and two, one a right-handed worker and the other left-handed, to pound it until it becomes a part of the ship. So the work goes on until after about two years the ship that existed only in specifications becomes a living thing.

"In putting this ship together the same methods are used as in a merchantman. The keel is first laid on big blocks, arranged at intervals of about three feet, on an incline of about five-eighths of an inch to a foot, so as to give the requisite pitch in launching. The Paris had an incline of half an inch to the foot, but for the battleships, which are shorter and nearly as heavy, a steeper incline is required. After the keel is laid the two frames in the center of the boat are put up, and then others fore and aft follow until the stern post and ram are fixed into place. The plates on the sides are riveted on, and it is not until the hull is half finished that we notice a radical difference between it and the hull of the merchantman. Then we catch the first glimpse of the protective deck. This is a turtle-back of steel, from three to four inches thick, reaching from side to side, and in most naval vessels from bow to stern. At the sides it extends about three feet below the water line. Below this deck are the engines, boilers and a spare steering apparatus. If a shot could get through the sides of the vessel it might kill men—that is to be expected in warfare—but it must pass through this sloping inner deck of steel before it can disable the vital parts of the vessel. It is this protective deck that makes valuable the cruisers that at present constitute the main strength of our navy. A shot might go through their pasteboard sides easily, but it would be a long time before the engines would be disabled in an engagement. It is on this protective deck that the steel fort of the Indiana rests. From the ends of the redoubt this protective deck runs fore and aft, to bow and stern, and if all this frail part of the vessel were shot away, the ship could still float and fight.

LAUNCHING DAY.

"So the building goes on until the launching day comes, and two broad ways are built against the bottom of the vessel, and the keel blocks on which it has been resting are knocked away. In the launch of the Indiana Mr. Nixon ran a row of electric lights beneath the bottom of the vessel, adding another innovation to the details of American shipbuilding. Each launching way consists of upper and lower planking, between which is spread thousands of pounds of the best tallow. At the bow of the boat these upper and lower planks are clamped together, and when all is ready they are sawed apart and the vessel starts. The upper part of the ways slides into the water with the vessel, and the lower part with the smoking hot tallow remains stationary. A launch in these days is so smooth and soon ended, rarely occupying more than twelve seconds from start to finish, that one scarcely realizes its difficulties. Three things are absolutely necessary: It must be on time, when the tidal water is highest; it must be of smart speed, so as not to stick on its downward journey to the water; and it must be accomplished without straining. So complex a thing is a launch that the careful engineer in charge is able to estimate the strain on every part of the vessel for every position it occupies, at intervals of one foot, on its way down the incline. There is one supreme moment. It is when the vessel is nearly two-thirds in the water. The buoyancy of the water raises the vessel and throws its weight on its shoulders. Here is where the greatest danger of straining comes, and should the ways break down, the vessel would be ruined, a matter of nearly $2,000,000 in a ship like the Indiana when it was launched."

### Intra-Coastal Canals.

Professor Lewis M. Haupt, Consulting Engineer of the Trades League of Philadelphia, presents in the *New Science Review* an article which emphasizes the position taken by the *Review of Reviews* for June as regards the importance of constructing interior canals along the Atlantic Coast. He says: "Probably nowhere in the world do there exist so great physical possibilities or so imperative commercial necessities for a deep water canal as along the Atlantic sea-board of the United States. This coast line, from Cape Cod to Florida Reefs, is a succession of sand bars, dunes and islands, inclosing large bays, sounds and navigable streams, and having comparatively few inlets where deep-draught vessels may safely penetrate this *enciente* of sand, and find a safe refuge from storms. The great risks to maritime property are shown by the reports of the Life Saving Service, which state that for the year ending June 30, 1893, the value of the vessels risked between Capes Cod and Hatteras was $2,825,765, while their cargoes aggregated $962,375, making a total of $3,788,140. The number of disasters during the year was 214, and the value of the property destroyed was $1,146,395, while that saved was valued at $2,641,741—so that 29 per cent of the property risked was lost. The greatest number of disasters (66) occurred that year in the Second District, which embraces the coast of Massachusetts, and the next largest number was on the coast of New Jersey, where there were 47 wrecks.

"From New York Bay to the Delaware Capes, 170 miles, there are no harbors of refuge, and even the Delaware Breakwater is no longer available for deep-draught vessels, while to the coasters it has proved very disastrous, for within a period of eighteen months no less than fifty vessels have been wrecked within its shelter.

"This is but one of many good reasons for the immediate opening of a capacious interior water-way along this coast. A more convincing and practical one, however, is the economy which would be effected by the great reduction in distance between our populous centers of industry. Thus the Cape Cod Canal, which is projected to connect the waters of Buzzard's Bay with Cape Cod Bay, at Sandwich, and is about 9 miles long, will reduce the distance between Boston and New York from 398 to 250 miles, a saving of 140 miles, or 35 per cent. The canal across New Jersey, from the Raritan Bay to the Delaware River, 34 miles long, would reduce the distance from 273 to about 90 miles, effecting an economy of 183 miles, or over 67 per cent; while the enlargement of the present Chesapeake and Delaware Canal, with a 10 feet draught and a length of 14 miles, would reduce the distance by water between Philadelphia and Baltimore from 430 to 112 miles, a saving of 318 miles, or 74 per cent.

"Thus it will appear that by the reconstruction or enlargement of 57 miles of canals, the present outside distances between these populous centers could be reduced from 1,101 to 452 miles, a saving of 60 per cent. This in itself would be an ample justification for the expenditure of a very large amount of capital to secure the result, but the physical conditions of the country which would be traversed by these canals is such that the actual cost of construction would be comparatively small. The estimated cost of the New Jersey link is $12,500,000, while the Delaware enlargement could be completed to tide level for $5,000,000, with the improved machinery now available.

"As the tonnage now afloat on the waters from Long Island Sound to Chesapeake Bay amounts to over $70,000,000, of which a large percentage would be greatly benefited by the creation of these connecting links, there would seem to be no question as to their financial success; and the dense population tributary to this highway of commerce is a sufficient guarantee to the statistician of an ample revenue from the existing and rapidly increasing traffic of this canal."

THE official full power forced draught trial of her Majesty's ship Ferret, built by Messrs. Laird Brothers, of Birkenhead, has been conducted with satisfactory results. The mean speed on the measured mile was 27·62, the maximum speed attained being 28·4 knots. The speed for the three hours was 27·51 knots with 175 pounds steam and 361 revolutions. The Ferret is the first of the new class of 27 knot torpedo boat destroyers, her displacement being 258 tons. No. 97 Torpedo Boat, built by Laird Brothers, Birkenhead, on her three hours' full power trial, made six runs on the measured mile, as follows: Steam, 170 pounds; revolutions, 363; speed, 23·71 knots; and I. H. P., 1,690. The speed for the three hours, 23·35 knots, was well maintained. The contract speed is 23 knots. This vessel is 140 feet long, with a displacement of 115 tons.

### The Subways of a Great City.

Mr. J. J. Waller, in *Good Words*, gives an account of the Parisian sewers, illustrated by diagrams of the interior of the sewer. The main sewers are 11 feet high and 16 feet broad, and are constructed of solid masonry covered with cement. Workmen are continually working on them, and the water only rises to the sidewalks after a very heavy rain fall. The sewers contain two water mains, as well as telegraph and telephone wires, and tubes for compressed air. "This ingenious system sprang from another embodied in a contract granted in 1881 by the Municipal Council of Paris to the Pneumatic Clock Company, who were given permission to place their tubes in the sewers on condition that they erected a given number of clocks in the public places of the city, and undertook to keep them to the time furnished daily at noon by the Observatory. The clocks are worked from a central office by the compressed air, and constitute a great public convenience. After twenty-five years from the date of the contract they will become the property of the city. As a set-off the company received a concession to establish and keep their pipes in the sewers for fifty years, for the purpose of distributing compressed air as a motive power throughout the city. A very wide use is made of so advantageous a system, for it obviates the purchase of an engine, saves space, time and trouble. All that is needed is a meter and the proper connections with the compressed air tube, then a turn of the tap, and the machinery is in motion."

The sewers are also used to accommodate the pneumatic tubes by means of which the carte telegrams are conveyed from one end of the city to the other. The convenience of having the telephone wires in the sewers is very great. There are thousands of miles of these connecting 244 post offices, as well as hundreds of private subscribers in every part of the city. Any subscriber in any part of Paris may be heard with ease in the General Post Office in London, and a whisper can be heard over the telephone in Paris, with the result that the hard swearing that goes on over the London telephones is almost unknown. The sluice carriage is run along the ledges of the sewers, while a tongue scrapes the side and bottom clean. The sewers are lighted with lamps, and not only is every thoroughfare inscribed on enamel plates, but every house which is connected with the sewer is also numbered. As many as fifty tourists a day go down the sewers in the tourist season to ride in the tourist car or sail in the gondola. The Paris Council has decided upon adopting the system of drainage which is in vogue in English towns. They are to spend thirteen million dollars in adapting the sewers to take all the sewage which at the present time is stored in cesspools. They are also going to spend ten million francs more in improving the water supply and the means of distributing it. One of the sewers passes under the river by means of a siphon 170 yards long and three feet in diameter. This is kept clean by inserting a wooden ball on the left bank of the Seine which almost exactly fills the tube. The pressure of the stream carries the ball down, and then, being of lighter specific gravity, it rushes to the surface, carrying before it everything that may have settled in the siphon.

### Another Great Fire in Chicago.

The embers of the burned Exposition buildings at Chicago had not been wholly extinguished when another conflagration took place in the lumber district. This was on August 1. An area equal to nearly fifty acres was burned over. An enormous amount of lumber was consumed. Among the great establishments destroyed were that of S. K. Martin Lumber Company, Blue Island Avenue and Lincoln Street, known as the largest lumber yards in the country, 35,000,000 feet of lumber and the offices consumed; loss, $700,000. Perley, Lowe & Co., lumber dealers; yards adjoining Wells, French & Co.'s foundry, 15,000,000 feet of lumber, chiefly soft pine, destroyed; loss, $300,000.

We regret to say one of the finest electrical establishments was also lost, that of Siemens & Halske Electric Company of America, manufacturers of dynamos, motors, and electric machines of all kinds, 1166 to 1182 South Wood Street, works completely destroyed; loss, $800,000.

Wells & French, manufacturers of car wheels, freight and refrigerator and street car works, from Wood to Paulina Streets, destroyed, including south casting foundry, wheel foundry, patterns, freight cars, and lumber; loss, $300,000.

Many other establishments were consumed.

The aggregate losses are placed at between two millions and three millions of dollars. Such great calamities have a disastrous effect upon the general industries of the country.

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### Character in the Engineering Profession.*

BY ISHAM RANDOLPH.

In constructive engineering, during the year 1892, although much has been done, few works in America have risen to a dignity commending national attention. With the most conspicuous of these our own members have been associated in a distinguished manner. The Mississippi, "Father of Waters," makes a rift in our continent which commences not far from British territory and works southward through sinuous convolutions more than three thousand miles to the gulf. Beginning at Brainerd, in the far North, the ever-widening stream is spanned, time and again, by railroad and highway bridges, until the Eads structure is reached at St. Louis. Between that and the gulf, for many years, the only communication between its opposite shores was by marine conveyance, but now there is another noble structure connecting Tennessee and Arkansas, at Memphis. This majestic structure adds one more notable achievement to the record of our distinguished member, George S. Morison.

On September 3 a notable event transpired in the Desplaines Valley, near the classic village of Romeo. Ground was officially broken and rocks rent by the official discharge of an electrical battery, for the great combined drainage channel and ship canal, which is to restore that connection between the great lakes and the Gulf of Mexico which those who read the earth's history, as recorded in the book of geology, tell us existed long before there was any other method devised for keeping the chronicle of great events. To make this event possible, our past president, L. E. Cooley, has given up his best years to ceaseless research, ill-requited labor, and often brutal criticism. Never was there a more notable example of what one persistent man can do to mould public sentiment and force legislative action. As the chief engineering executive of this great enterprise, we recognize another of our past presidents and most valued members. During this year, as if by magic, vast and magnificent structures have reared their majestic proportions within the domain of the people of Chicago known as Jackson Park. Civil engineers have supplied the grand arches and ribs of steel which made it possible thus to excel in vastness every building enterprise which earth in its unnumbered centuries has borne upon its bosom; and architects have taken these giant skeletons and covered and veneered them with counterfeited marbles in dignified and fair proportions, until the work of these brother craftsmen strikes wonder, admiration, and awe into the hearts of all beholders.

The night is wearing on and I must yield the floor to others, but not until I have addressed myself to the young men of our organization—the forceful, hopeful, earnest contingent, who strain the eyes of imagination dipping "into the future, far as human eye can see," striving to draw aside the curtain which hides "the vision of the world and the wonder that shall be." Young men, I feel as if I had a right to speak to you, because my sympathies are so strongly with you, and because it seems but yesterday that I, too, was young; but on from the yesterday of my youth the resistless force which drives the flying chariot of time has forced me to the past meridian of life. And from that vantage ground I speak to you to-night. You have joined battle with the forces of the world, you stand shoulder to shoulder with the men who are grappling with the raw materials of the universe and moulding and shaping and framing them to fit the multiform needs and uses of earth's myriad inhabitants. Some of you come armed cap-a-pie for the contest, others face the battle with an equipment but little better than the shepherd's sling and the few smooth stones from the brook. To the one class I would say, be not too confident. To the other, be not cast down by the scantiness of your preparation.

In what I am about to say I would not be understood, for one moment, to underrate the value, the vast advantage, of a thorough scientific and liberal education. Few men have coveted more earnestly than I the possession of just such an education, and few have attained worthy results with more labor than it has fallen to my lot to endure in prosecuting my life's work, because I lacked this equipment for its duties.

The first essential to success in life is the possession of a sound mind; and what is not possible to him who has a sound mind domiciled in a sound body, with a strong will to urge both to highest effort? Take two such men, with equal natural powers, and equip one with a thorough knowledge of the laws of nature and the best methods of turning the forces of nature to account in the work which lies before him ere he can reach the goal of success. Then let both men choose the same goal. Will not the man who knows how reach it long before the man who has to learn how? But the last man will get there, if no infirmity of purpose overtakes him. Then, again, take two men, one with a natural gift for certain lines of work or research and the other with no such gift, but with years of training and discipline to fit him for the work, and the race will not be so unequal as in the first case; when the one reaches the goal the other will not be far behind him, and it is a question which will reach it first. The schools, colleges, and universities, which stand like storehouses of knowledge all over the land, have a mission to mankind which is helpful and ennobling. But whence came our engineers before these temples of learning were reared? What faculty graduated John B. Jervis? Did Benjamin H. Latrobe pass from classic shades to the fields and forests, the rugged mountains and the brawling torrents, where he exercised that skill which gave him his great name? What of Roswell B. Mason? Was he a graduate? E. S. Chesbrough left monuments behind him which made him famous on two continents for his constructive genius while he lived, but can his descendants point proudly to their father's diploma? How many years was James B. Eads coached by professors before he built that gunboat fleet or flung those ribs of steel across the Mississippi, or planted the jetties at its mouth, or conceived the idea of the ship railway? What college trained Thomas U. Walter between the time of his dropping his bricklayer's trowel and his building the capitol of this nation?

I might go on and on, but these proud names will suffice to show that while knowledge is power, it is not all pre-empted by the schools. Take heed then, you young men, who oftentimes feel cast down by the odds you think you see against you. If you have a genuine love for the work which is the daily lot of the engineer, devote yourselves to it, and remember that you have more help than the men before you, who, single handed and alone, wrought out of their inner consciousness the means by which they attained their ends. And now to those of you who have the equipment of varied knowledge, learn to handle it aright, and because you know so much, do not fall into the error of believing that you know it all. The man who reaches that conclusion will not go far before he overtakes confusion and disaster. I have had men under me by whose knowledge I was fairly appalled. They were walking encyclopedias, versed in signs that failed not to the tenth decimal, but so constantly flying off at tangents that they became eccentric to a degree which destroyed their mental balance and they could not be trusted to do common-place, every-day work that pertains to our duties without having an *ignoramus* along to keep them straight. You who have this splendid equipment, learn to use it so that it may be effective. Watch the *practical men*, see where they fail for want of what you possess. Harness your theories for the everyday work of life, and if they are true, your work will be the better for their aid; but if false, you will soon demonstrate the fact, and lean upon the true and cast away the fallacious. As I look upon you all, I read in your faces the laudable ambition to reach success. What is success? How many standards are there? Some unthinking or sordid listener might reply, The accumulation of vast wealth—that is success. Others again will say the attainment of power and position is the goal of our desires. And still others will ask for a good name, with the ability to owe no man anything, and the calm consciousness that in the attainment of these they had wronged no man.

He who gauges success in our profession by the money standard has a low conception, indeed, of the full import of the term. Judged by the measure of accumulated gains, the lives of ninety per cent of the men whose names shine upon the pages of human endeavor have been flat failures. One of our humorists, I think we must credit it to Josh Billings, has said: "It is easy to see what the Lord thinks of money by the people he gives it to." True success is impossible apart from probity and honor, and it is a fact, which must not be lost sight of, that the men who by their ability and skill have placed the engineering profession upon the high plane it occupies to-day have been men of exalted characters. And how are characters built up? Can a fabric of truth rest upon an aggregation of lies? Does honor rear its head above a stagnant pool of immorality? Does integrity come forth from a heart full of dishonest intention? No, my friends; you can no more rear a noble character upon a foundation of unstable or corrupt morals than you could sustain the Auditorium upon the muck and slime of a morass. There is not a man here to-night who has attained to responsible position who cannot revert in thought to not one, but several men, with whom his professional life has brought him in contact, whose failures, utter and complete, were traceable to the absence of character. I have known and loved and yearned over such men as these. I have had comrades who were manly and generous and gentlemanly, gifted by nature with mental ability and re-enforced by the schools, but lacking in some vital element of character. In their training the item of self-control had been left out, passions and appetites dominated their lives, or indolent self-indulgence stayed their hands from every effort worthy of their ability. In offices throughout our land such men as these are eking out miserable existences, cursing fate for their ill-luck, and drifting on helplessly and hopelessly into the oblivion which will whelm them at last. Young men, aim high in all things, but aim highest of all in character. And now the king is dead, but his disembodied spirit hovers near to wish the king a successful, a beneficent and a glorious reign.—*Journal of the Association of Engineering Societies.*

* Extract from address of retiring president, Isham Randolph, Western Society of Engineers. Delivered January 4, 1893.

### Bathing in Typhoid Fever.

In a note in the *Medical Record* by Dr. William B. Noyes, of New York, he says:

Every new medical text book and periodical accumulates statistics testifying to the brilliant results following the use of cold baths in typhoid fever. The hospitals in which this method is chiefly carried on are almost, without exception, showing a higher percentage of recoveries than ever before under any other plan of treatment.

Why is it, then, that this method is not universally adopted and carried out in private practice? The answer is simple. Easy as it is in a hospital with an abundance of skilled assistance, there is no method of treatment in use so difficult to carry out properly as tubbing in typhoid fever in private families.

It is a very easy thing to slip a rubber blanket under the patient, and raise the two sides and the ends at the foot and head of the bed, nine or ten inches, by a row of pillows, bolsters, sand bags, or simple boards.

The rubber blanket ought to be of double thickness, as large as can be purchased, and special care must be given to the arranging of the corners. When this is done you have the patient at the bottom of an impromptu bathtub, into which you can pour water at any desired temperature, and in sufficient quantity to partially or entirely cover his body.

Only two inches of water would be enough to give a cool sponge bath ten times as efficacious as the gingerly sponging possible under ordinary circumstances, and if the sides and corners are firmly fixed, you can easily make this tub hold all the water you desire. The water may be run from the nearest faucet by a rubber tube. I have found it a simpler and equally successful method to carry it in pails and pour it over the patient, starting with tepid and gradually cooling it down to the desired temperature.

The neatest method, I have found by experiment, is to use a large "watering pot," with a sprinkler, such as is used for watering plants. This is a method which will not commend itself to those who dislike humble and commonplace methods to accomplish something that more complicated and more impressive methods might do.

I believe that this kind of a bath will always be grateful to the patient, and if it is found necessary to use water at a decidedly low temperature, would give rise to less shock than a sudden plunge into a tub filled with very cold water. The effect on the temperature is the same as it would be under the other method with a stationary tub.

The water can be removed, without spilling a drop on the bed, by siphoning with a rubber tube, or dipping with a small pitcher or cup, or sponging. Then the blanket can be dried and left in place, covered by a clean sheet, or, better yet, removed and dried in the sun.

THE resistance of canal boats to traction has been investigated for the Ministry of Public Works of France by M. De Mas, the account of the experiments being given in a two-volume report issued recently by the ministry. It was found that at a speed of 3·28 feet a second the resistance of the 70 odd types of barges ranged anywhere from three to eight pounds per square foot of immersed section. If the resistance at a speed of 5 feet a second with a draught of 3·28 feet (1 meter) is called unity, the resistance with a depth of 4·27 feet (1·3 meters) becomes 1·13, and with a draught 5·25 feet (1·6 meters) becomes 1·27. That is to say, the resistance does increase with the displacement of the boat, but more slowly. Another fact found out was that the resistance may be much reduced by using smooth surfaces below the water line, the total resistance of a wooden barge being diminished from 782 to 551 pounds by covering the sides with oilcloth. The length of the boat was found to have little influence on the traction when the speed was five feet or more a second, but the form of bow and stern was shown to be important, a spoon-shaped bow giving the best results.

### Italian Wages.

The British vice consul at Ancona, in a recent report on the trade of that district, gives an additional instance of the low wages paid in Italian industrial establishments. At the metallurgical works of Messrs. D. Cattro & Co., a firm giving constant employment to over 200 hands, although wages have increased by about 10 per cent in the last three years, the average rates paid per day of 10½ hours are—to boilermakers, 3s. 2d.; iron founders, 2s. 11d.; riveters, 2s. 11d.; turners, 3s. 2d. The works are being enlarged, and accommodation will be provided for building steamships of any size or tonnage. Coal, coke, pig iron, and all materials for boiler making are imported from Great Britain.

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## AUTOMATIC COUPLER TESTS.*

The committee of the Master Car Builders' Association decided, as its work for 1894, to make three series of tests, approximating as nearly as possible the conditions of service:

1. A drop test of couplers resting on a draught spring, a slight allowance of lateral play being given the shank. This test, by transmitting the blow to the solid foundation through the draught spring and through the horn, represents, as nearly as can be, the service required of couplers in resisting concussion.

2. Guard arm tests with couplers supported as above, to determine the relative strength of the guard arm and the shank immediately back of the head. This test was considered most important, on account of the very large percentage of failures at these points.

3. Jerk tests representing the strains which couplers are called upon to resist in starting heavy trains, or when trains pass over points of change in grades. The committee, before deciding upon this last test, gave the subject full consideration, and was led to the method adopted to reproduce service shocks as nearly as possible on a machine. It was thought by it that couplers tested in this way might give different results from those tested under the steady pull of a tensile machine, and it was further believed that if this system of tests gave results of value, it would enable the whole series of coupler tests to be made on one machine.

In order to carry out these tests, the committee was obliged to redesign and build a new drop test machine. Profiting by the experience of the previous year, the machine was made very much heavier and stronger, and is fully shown in the illustrations.

The specifications under which the tests were made provided in part as follows:

### STRIKING TEST.

Two couplers taken at random shall be used for this test. The draw-bar shall rest on a standard freight draught spring and to be held in position as arranged for in the construction of the machine, so that the horn will stand off 1¾ inches from the striking plate. Draw-bars shall receive blows on the knuckle from a weight of 1,640 pounds dropped three times from a height of five feet, and three times from a height of ten feet, blows to be continued from a height of fifteen feet until couplers are unserviceable.

### GUARD ARM TEST.

One coupler shall be used for this test. It shall be held as described in the striking test, but in a position to bring the guard arm below the drop. Draw-bars in this test shall receive three blows from a weight of 1,640 pounds dropped from a height of three feet, striking squarely on the point of the guard arm, blows to be continued from a height of five feet until guard arms or draw-bars are fractured.

### JERK TEST.

Two draw-bars shall be used for this test and shall be inverted and placed in the machine together, suspended from pedestal by tail bolts and yokes and freight draught springs, allowing 1¾ inches between striking plates, and held in position as arranged for in the construction of the machine. A weight of 1,640 pounds to be dropped on an equalizer bar connecting the two couplers, three blows from a height of five feet and three blows from a height of ten feet; blows to be continued from a height of fifteen feet until coupler is destroyed or unserviceable.

Twenty-one complete sets and four incomplete sets were tested, and of this number fourteen were made of malleable iron and eleven of steel, all couplers being equipped with steel knuckles. The results obtained in the striking tests show 16 per cent of the shanks cracked and broken behind the head; 26 per cent cracked and broken in the head; and 44 per cent of knuckles broken.

In the jerk tests the equalizing bar was so shaped at the ends as to bring direct pull upon the knuckles of the pair of couplers under test, with the least possible spreading action. The results of the test show 9·5 per cent of the couplers broke in the heads and 26 per cent of the knuckles broken; the remaining couplers were thrown out on account of distortion beyond the limits of the test by the combined failure of pivot pins, knuckles and locks.

The result of the striking and jerk tests, considered together, show that out of ninety-two couplers 22·8 per cent of the knuckles were broken or cracked and 30·4 per cent of the couplers broken, either in head or shank; but the breakage in knuckles would probably have been greater had not many of them been thrown out on account of being beyond the limit, before they were broken—52 per cent of the couplers failing on this account; which goes to show that the pivot pins are generally weak, allowing knuckles to close before any other damage has been done. It will be observed that coupler lug failures are exceedingly few.

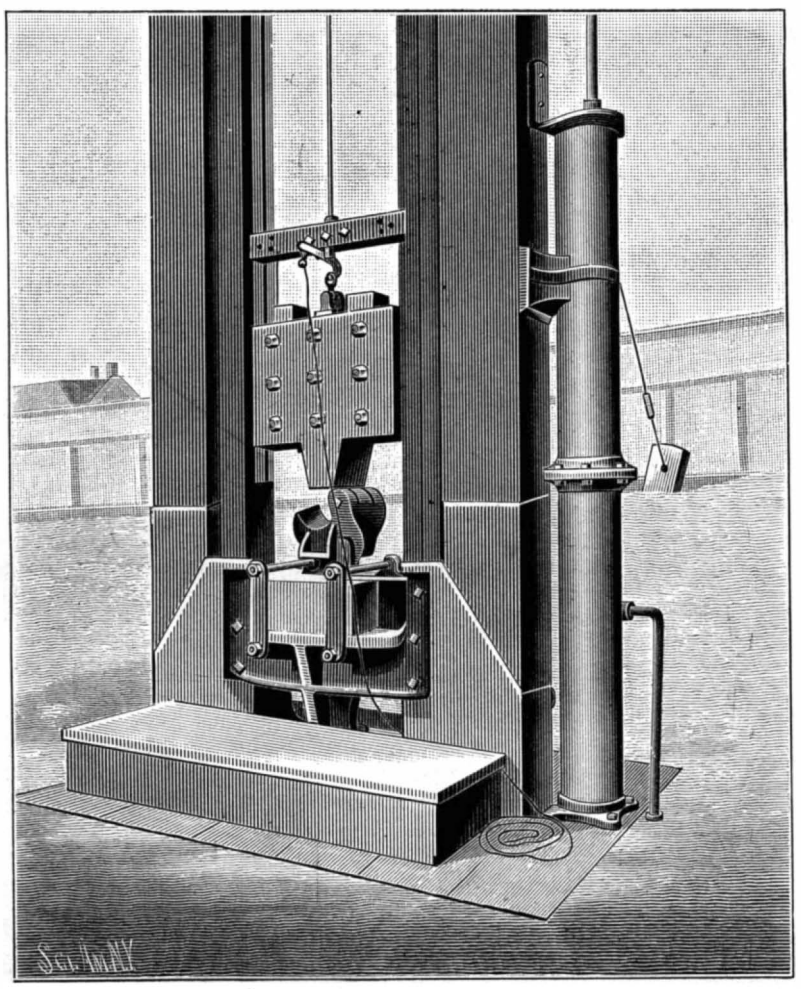
Of knuckle failures, 70 per cent are in tongue, 14 per cent in one or both of the lugs, and the same percentage in pinhole.

The guard arm test may be criticised as artificial and arbitrary. Service has shown, however, that a very large percentage of coupler failures is due to guard arm breakages, the result, no doubt, of blows from ordinary link and pin couplers glancing from closed knuckles or striking directly upon the guard arms.

The results of the test are, 68 per cent broken shanks, 27 per cent broken guard arms, and 18 per cent broken locks, some couplers combining two or more failures.

The result of this test conflicts with the observation of service, for whereas in actual service there is a preponderance of guard arm failures, in the test the shank failures are in excess. The probable explanation is that direct blows concentrate the shock on the opposite side of shank, whereas a glancing blow or one from a broken link and pin coupler wedges off and breaks the guard arm alone.

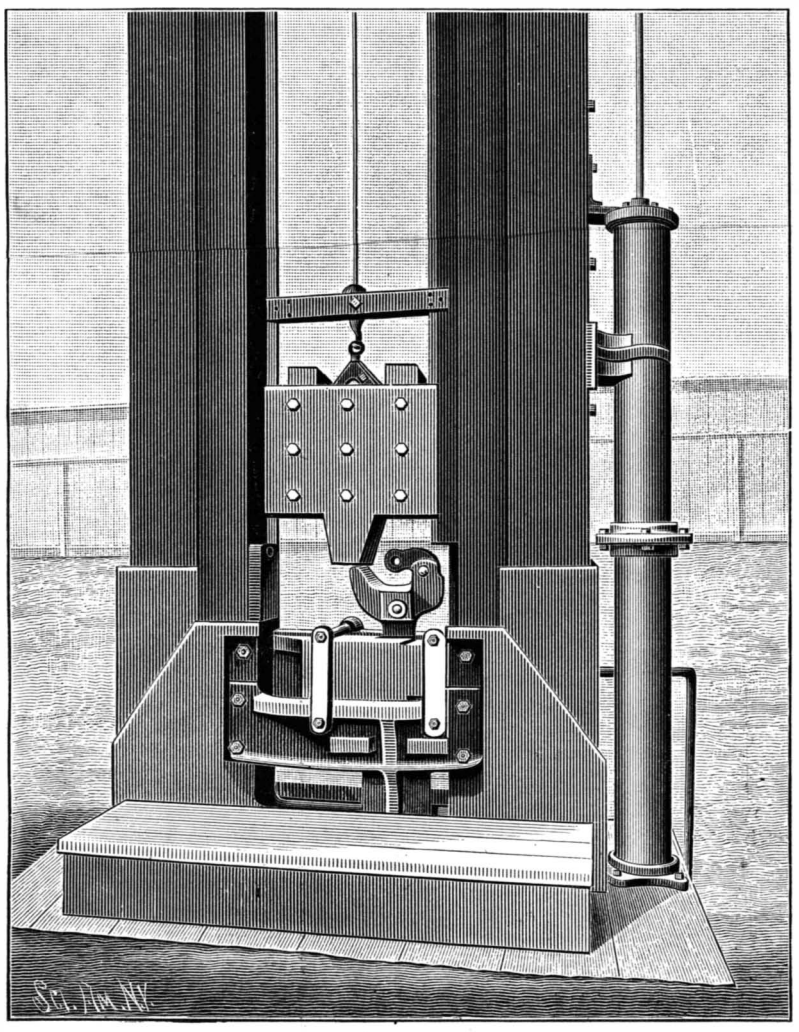
* Abstracts from a report presented to Master Car Builders' Association at Saratoga, N. Y., June, 1894.



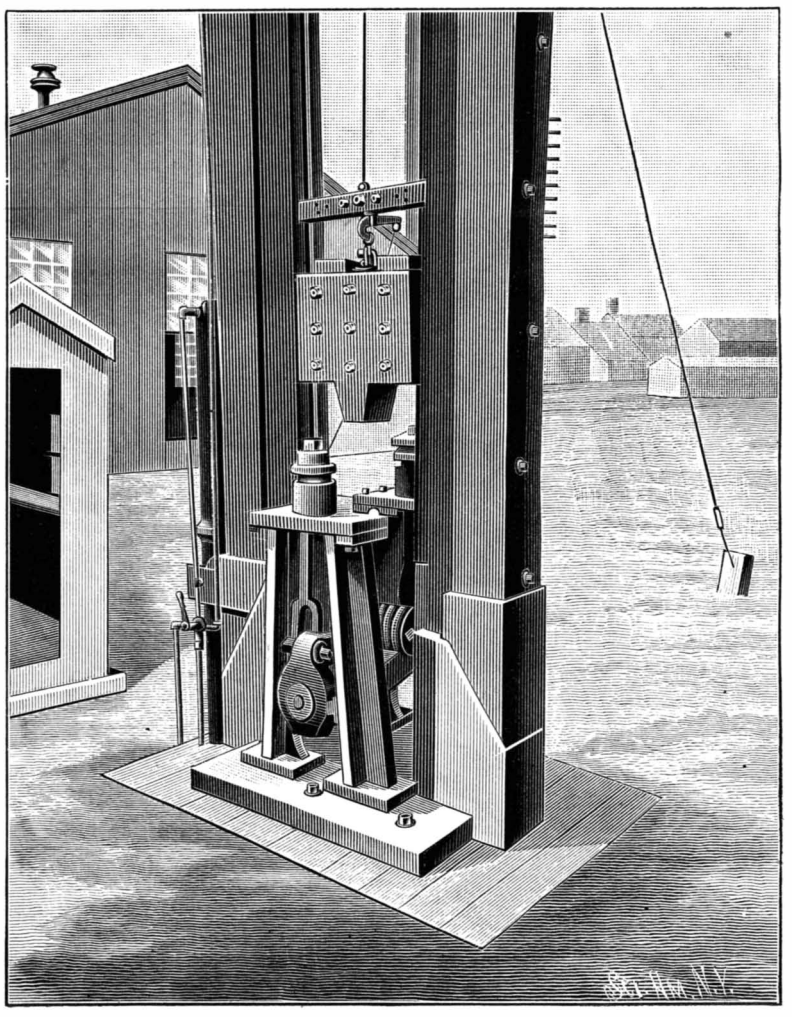
CAR COUPLER STRIKING TEST.

## Simon Ingersoll.

Simon Ingersoll, the inventor of the Ingersoll rock drill, died at his home in Glenbrook, Conn., on July 24, at the age of 76. He had lived in retirement for some years, and was a plain and unassuming man. He died poor, although others made fortunes, by their efforts and business skill, out of his inventions.



CAR COUPLER GUARD ARM TEST.



CAR COUPLER JERK TEST.

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### THREE SPECIMENS OF STARLING.

In to-day's issue we reproduce an engraving from Brehm's "Thierleben," showing three interesting species of starling, the *Pholidauges leucogaster*, the *Lamprocolius chalybaeus*, and the *Lamprotornis aeneus*. The first of these is a native of central Africa and western Arabia, where it usually lives in thin woods on precipices or at the foot of mountains, but even those birds that stay on the plains never go far from the mountains. They live in families of from six to twenty members, high up in the trees, seldom descending to the ground, and then remaining there the shortest possible time. These birds are very small and are distinguished from other members of their subfamily by the shape of their beak—which is slightly curved and tapers very much—their delicate but long-toed feet, comparatively short wings, a moderately long tail, and a scaly, glossy plumage. The back and neck are purplish-blue, shading to a violet; the breast is white, and the wings dark brown, bordered with violet. All of the dark parts have a brilliant luster, and on account of iridescence the coloring seems quite different when the bird is at rest or in motion. Even in Abyssinia, which is so rich in birds of beautiful plumage, this one is remarkable. Its eye is light brown, and its feet and beak are black. Its flight is very rapid.

The *Lamprocolius chalybaeus* are quite numerous in northeastern Africa. This is also a bird with glossy plumage, which is so wonderfully lustrous that it will reflect a ray of sunlight as if it were a mirror. The feathers lose most of their beauty immediately after death. The prevailing color of the plumage is a dark steel green, and there are velvety black spots on the wing feathers. There seems to be no difference in the coloring of the male and the female, but the feathers of the young birds are not lustrous. These birds live in the thick forests of the river valleys or the thinner woods of the steppes or mountains of northeastern Africa. In Abyssinia they are found on high ground. They generally live in pairs; but at brooding time—from July to September—they form little companies, and there are often six to eight nests in a tree. They prefer to build in hollows of trees, which they line carefully. The male assists in the care of the eggs and of the young birds. They are bright, happy little birds, flitting about on the ground or among the low bushes during the day, but returning to the high trees at night. Their chirping and calling can hardly be called a song. This bird is often referred to in the legends and songs of Abyssinia.

The *Lamprotornis aeneus* is the best known of its species. It is at home in eastern, western, southern, and central Africa, where little companies of the birds are found together, spending most of their time in high trees, but coming to the ground for worms and insects. Their breeding time is in August, the rainy season which brings the spring of that country, and the eggs are cared for and the young birds are fed by the male as well as the female. The coloring of this bird is beautiful, its head and throat are black with a golden sheen, the upper parts of the wings are dark metallic green, and some of the wing feathers are decorated with velvety black spots; the long tail feathers are a dark purplish-violet, and the breast feathers are copper colored. All of the feathers are very glossy. The eye is light yellow, and the beak and feet are black. Its song is nothing but a repetition of the ordinary chirping and calling. These birds live for a long time in captivity.

1. PHOLIDAUGES LEUCOGASTER. 2. LAMPROCOLIUS CHALYBAEUS. 3. LAMPROTORNIS AENEUS.

NOT only do the forms and character of the blossoms of the chrysanthemum vary greatly, but there is a wider variation in the color than in any other flower.

### Drift Mining in California.

The western slope of the Sierra Nevadas in this State, from Mariposa to Siskiyou, contains the great area in which drift mining in California is practicable and profitable. In Nevada, Placer and Sierra Counties is found the richest ground, though Plumas, Butte, El Dorado, Amador, Calaveras and Tuolumne Counties have many important drift mines. There is almost a uniform geological character to this entire district, the main axis of the great mountain range from its summit thirty miles westward being granite. Westward to the Sacramento and upper San Joaquin valleys occur almost uninterruptedly metamorphic stratified rock, slate and limestone forming the largest part. Research indicates that the prehistoric rivers that ran through this region were wide and deep, but comparatively short. Occasionally are found two lines of those ancient channels bisecting each other at almost right angles, indicating their distinct and separate formation in periods of time boundless by ordinary computation. In those old days when the world was young, into these old channels filling up with bowlders, gravel and sand, was also washed gold from the quartz veins. The close of this Pliocene period eons of ages ago was marked by a lava flow covering and sealing that auriferous deposit in some cases a thousand feet deep. In the present geologic period the streams now on the surface, trending more straightly westward than their buried brothers, have eroded through this lava, through the ancient debris, and in many cases through the slate. A part of the gold thus brought to light by Nature's slow processes has been secured by man during the past forty-five years. Its source and fountain seat is only to be unlocked by drift mining. Drift mining may be considered as a branch of placer mining. It was in the early days of placer mining that the origin of the placers was discovered. The miners of forty years ago, as their placer claims were being worked out, naturally looked eastward and upward to the hills, and working higher, came to places beyond which no surface trace of gold was found, the gravel "vein" running into the mountain. In tunneling on the bedrock they found it pitched downward as it went into the mountain, the result being that they were ordinarily drowned out. This was the incipiency of drift mining, the plan adopted being running tunnels on an up grade from the lowest practical point, thus draining the drift and making it easier to move the gravel.

There is no field more promising of returns than the development of drift mines. The preliminary cost of such development can be greatly lessened by judicious expenditure at the start in securing intelligent survey of the ground proposed to be worked. Proper platting of the probable course and grade of the gravel sought by a competent engineer, while not infallible, is far preferable to haphazard prospecting, which often uses up considerable money with unsatisfactory result. Prospecting, of course, is necessary, but before much money is spent the services of a good mining engineer will be found to be a matter of practical economy. A prospecting shaft is rarely necessary where the conformation of the surface will not permit tunnel or drift prospecting from the face of the mountain, that depending greatly on the thickness of the overlying strata of earth and rock. The definite and regular work on a drift mine by shaft is a costly process, tunneling on an easy grade being in nine cases out of ten the cheapest and most satisfactory way. In this branch of mining the risks and expense are counted small when the yield is so great as in numerous familiar instances in California's mining history, where $10,000 was got from one carload of gravel, or where over $750,000 was secured from half an acre of rich ground.

It is probably no exaggeration of facts to say that for every dollar taken from the ancient river channels of California there remains ten to be added to the world's wealth by drift mining.—*Mining and Scientific Press.*

### Training Tumbler Pigeons.

We have known many purchases made of "Birmingham Rollers," and great disappointment expressed at the after performance of the birds or their progeny, simply from carelessness in their management. The best flying tumblers in the world, if left to fly at will, will rapidly degenerate. Each flier has its own little details of management, which, after all, matter very little; the essential point is that in beginning to train the birds are only let out occasionally, say every three or four days, and when hungry, be it morning or evening. The reasons for both precautions are: (1) The previous confinement causes them to fly actively at once upon being liberated, and (2) their appetite leads them to a quick return as soon as they have had exercise enough.

They must be fed immediately on return to keep up this habit; plentifully while only occasionally flown, but lightly when, being trained, and let out in the morning, they are going to be let out again in the evening; their full meal being in this case reserved till after the last fly. If of good stock, and first tossed when there are no birds to tempt them to "pitch," they soon get into the habit of bursting off the moment they are liberated; and this habit must be very carefully preserved, weeding out instantly, as soon as discovered, any unusually lazy bird, which would otherwise be a check upon the rest, and may lead them to descend with it. No other system is needed beyond this in training tumblers.—*Liverpool Courier.*

ONE extra good winter blooming fuchsia is speciosa. Given a large pot, light fibrous soil of leaf mould and sand, good drainage and plenty of water at the roots and overhead, it will make rapid growth and flower abundantly from January to April without cessation.

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## The Moon.

BY LEWIS SWIFT.

The most glorious object on which the eye of man ever rested is the sun, after which comes the moon when shining with a full, round face. It is difficult, indeed, to conceive that an object of such brilliancy is, in reality, a dark one, in itself as devoid of light as is the earth at midnight in the absence of the moon. Moonlight is simply sunlight received second hand, the light of the sun being reflected from the moon's dark surface. This is true of all the planets also, though not of the stars, as they all are suns self-shining as our own, a fact previously given.

If to behold the full moon is a spectacle so inspiring, her crescent with its horns pointing either to the right or left, or, again, upward as she nears the setting sun is hardly less so, and in this place demands special attention, as, from long experience, I find the cause of her assumption of the crescent, the half and the gibbous phases to be very imperfectly understood, it being often imagined, even, that some dark body passes between the earth and the moon, and cuts off her light wholly or in part, and suggests the question often asked of me, "What is the object which thus intervenes?" Of all the countless host of stars, comets and planets, the moon is nearest to the earth, and, consequently it is not possible for any other body to come between her and the earth.

The moon's easterly motion is about thirteen degrees daily, and her complete revolution around the earth occupies about 27⅓ days, but as, during this time, the sun has moved also easterly one degree per day, the moon, to overtake the sun and produce a new moon, has to make more than a complete revolution. This requires a little more than two days, so that from new moon to new again is not 27⅓, but 29½ days, the length of a lunar month. The instant of the new moon is when the moon passes the sun, her illumined side being, of course, wholly turned toward that luminary, and her dark and, consequently, invisible side toward the earth. As she emerges from the sun a constantly increasing portion of her sunny side turns toward us, and we see her first as a slender crescent which nightly grows in size until after the lapse of a little more than seven days after passing the sun she appears as a half moon, one-half of her sunny side being turned toward us, or, as the almanacs say, at first quarter. Nightly, more and more of her bright disk presents itself until, rising when the sun sets, her entire luminous portion is turned to us as well as to the sun, and we see her as the full-orbed moon. Then, in reverse order, the above changes are gone through until a fortnight has elapsed, when she again passes the sun and becomes invisible.

Although the full moon in a cloudless sky floods the earth with radiance and splendor and invests even the most unlovely objects with a softened beauty, yet it would require more than six hundred thousand moons shining at once to equal the light of the sun.

It is a curious and an unexplained fact, and, probably, not an exceptional case in the solar system, that the moon revolves round the earth in exactly the same time required to rotate on her axis, thus forever preventing her posterior hemisphere from being seen, and, therefore, we are and must remain ignorant regarding the topography and scenery of the opposite side.

The inhabitability of the moon has in every age been a fruitful theme for reflection and discussion, but the invention of the telescope has settled the question in the negative. As it is a world entirely destitute of an atmosphere, as it has no water, not a drop, and as its days and nights are, each, equal to two of our earth-weeks, and as, furthermore, no change has been observed since it became an object of telescopic study, we are forced to the conclusion that it cannot be the home of sentient beings and that it cannot sustain life of any sort. Are we then justified in the belief that this heavenly body has been created in vain? No; we owe much to the moon. She raises the ocean tides, and their ebb and flow serve to keep the waters of the gulfs, bays and estuaries of the earth from growing stagnant. And to sailors at sea she is of great service in determining positions.

The moon as a telescopic object surpasses in magnificence all others in the heavens. On favorable occasions she can approach to less than 220,000 miles from the earth, or, from surface to surface, to within 215,000 miles. If at such a time a magnifying power of, say, two thousand be applied, she will be seen as though at a distance of over 100 miles. Under these conditions, an object as large as the Capitol at Washington could be seen as a visible point.

It is not possible for any telescope ever to do better than that. The idea promulgated by sensational writers regarding the giant telescopes that must, when completed, bring the moon to within a few miles or even to a distance of a few yards is wholly erroneous. To see the moon well there is no need of a mammoth telescope, as she has sufficient light to bear a high power, yet our atmosphere is so laden with vapors and lashed with tremors which are magnified as much as is the moon itself, that the close investigation ardently desired by astronomers is prevented thereby, and only low magnifying powers can be used. But the lunar scenery even under these not most favorable conditions is grand beyond the power of words to express. The great telescope of the Lowe Observatory with its incomparable eyepiece, specially adapted for the work, will reveal her mountain heights and craterous depths, her yawning canyons and dry ocean beds, where, when the moon was young, tides ebbed and flowed.—*Mount Lowe Echo.*

## The Railway Mileage of the World.

In a recent issue of the *Archiv fur Eisenbahnwesen* are printed a series of tables giving some interesting data regarding the railways of the world. The figures for the year ending December 31, 1892, are as follows:

| COUNTRY. | Length miles. | Length 100 sq. miles. | Per 10,000 inhabitants. |
|---|---|---|---|
| **I. EUROPE.** | | | |
| Germany: | | | |
| Prussia | 16,275 | 12·1 | 5·3 |
| Bavaria | 3,597 | 12·2 | 6·3 |
| Saxony | 1,584 | 27·4 | 4·4 |
| Wurtemburg | 967 | 12·9 | 4·7 |
| Baden | 1,000 | 17·1 | 6·0 |
| Alsace-Lorraine | 1,005 | 18·0 | 6·2 |
| All other German States | 3,027 | 15·0 | 5·8 |
| Total Germany | 27,455 | 13·2 | 5·5 |
| Austria-Hungary, including Bosnia, etc. | 17,620 | 6·8 | 4·1 |
| Great Britain and Ireland | 20,325 | 16·7 | 5·3 |
| France | 24,018 | 11·6 | 6·3 |
| Russia, including Finland | 19,656 | 1 | 2 |
| Italy | 8,498 | 7·7 | 2·7 |
| Belgium | 3,379 | 29·6 | 5·5 |
| The Netherlands, including Luxemburg | 1.913 | 14·0 | 4·0 |
| Switzerland | 2,082 | 13·0 | 7·1 |
| Spain | 6,771 | 3·4 | 3·8 |
| Portugal | 1,425 | 4·0 | 3·0 |
| Denmark | 1,283 | 8·4 | 5·6 |
| Norway | 971 | 0·8 | 4·8 |
| Sweden | 5,259 | 2·9 | 10·9 |
| Servia | 336 | 1·8 | 1·6 |
| Roumania | 1,622 | 3·2 | 3·2 |
| Greece | 569 | 2·3 | 2·6 |
| European Turkey, Bulgaria, Roumelia | 1,130 | 1·1 | 1·2 |
| Malta, Jersey, Man | 68 | .... | . . |
| Total Europe | 144,380 | 3·9 | 4 0 |
| **II.—AMERICA.** | | | |
| United States of America | 174,784 | 6·0 | 26·8 |
| British North America | 14,870 | 0·5 | 30·8 |
| Newfoundland | 243 | 0·6 | 11·9 |
| Mexico | 6,625 | 0·8 | 5·5 |
| Central America | 622 | 0·3 | 1·9 |
| United States of Colombia | 261 | 0·0 | 0·7 |
| Cuba | 1,076 | 2·4 | 6·6 |
| Venezuela | 497 | 0·2 | 2·1 |
| Republic of San Domingo | 71 | 0·3 | 1·4 |
| Puerto Rico | 11 | 0·3 | 0·1 |
| Brazil | 6,390 | 0·2 | 4·3 |
| The Argentine | 8,163 | 0·8 | 18·9 |
| Paraguay | 157 | 0·2 | 3·4 |
| Uruguay | 1,056 | 1·4 | 13·7 |
| Chile | 1,926 | 0 6 | 6·0 |
| Peru | 1,036 | 0·2 | 3·5 |
| Bolivia | 593 | 0·2 | 4 1 |
| Ecuador | 186 | 0·2 | 1·2 |
| British Guiana | 22 | .... | 0·7 |
| Jamaica, Barbadoes, Trinidad, Martinique | 321 | .... | .... |
| Total America | 218,910 | . . | .... |
| **III.—ASIA.** | | | |
| British India | 17,768 | 1·1 | 0·6 |
| Ceylon | 191 | 0·8 | 0·6 |
| Asia Minor | 998 | 0·2 | 0·6 |
| Russian trans-Caspian district | 890 | 0·5 | 12·7 |
| Persia | 34 | .... | .... |
| The Dutch Indies | 1,068 | 0·5 | 0·4 |
| Japan | 1,876 | 1·3 | 0·4 |
| Portuguese India | 51 | 3·5 | 1·0 |
| Malay States | 87 | 0·3 | 1·4 |
| China | 124 | .... | .... |
| Cochin China, Pondicherry, Malacca, Tonkineto. | 142 | .... | . .. |
| Total Asia | 23,229 | .... | .... |
| **IV.—AFRICA.** | | | |
| Egypt | 961 | 0·3 | 1·4 |
| Algeria and Tunis | 1,984 | 0·6 | 3·5 |
| Cape Colony | 2,444 | 1·1 | 15·2 |
| Natal | 399 | 2·1 | 7·3 |
| Transvaal | 194 | 0·2 | 2·5 |
| Orange Free State | 559 | 1·1 | 26·9 |
| Mauritius, Reunion, Senegal Territory, Angola, Mozambique, etc. | 671 | .... | .... |
| Total Africa | 7,212 | ... | .... |
| **V.—AUSTRALIA.** | | | |
| New Zealand | 2,008 | 1·9 | 30·9 |
| Victoria | 2,920 | 3·4 | 25·0 |
| New South Wales | 2,399 | 0·8 | 20·0 |
| South Australia | 1,823 | 0·2 | 54·9 |
| Queensland | 2,352 | 0·3 | 55·9 |
| Tasmania | 467 | 1·8 | 30·6 |
| West Australia | 660 | .... | 111·8 |
| Hawaii | 56 | 0·8 | 6·2 |
| Total Australia | 12,685 | 0·3 | 31·2 |
| **RECAPITULATION.** | | | |
| Europe | 144,380 | 3·9 | 4·0 |
| America | 218,910 | .... | .... |
| Asia | 23,229 | .... | . .. |
| Africa | 7,212 | .. . | .... |
| Australia | 12,685 | 0·3 | 31·2 |
| Total of the world | 406,416 | .... | ... |

The reports show that the total capital invested in the railroads of the world at the end of 1892 was in round numbers $32,150,000,000, or an average per cost mile for the entire world of a little more than $79,000 per mile.

## The Ivanhoe Tunnel.

The Ivanhoe tunnel, the third longest in America, is cut straight through the backbone of the Rocky Mountains from Busk, a small hamlet fifteen miles west of Leadville, Col., to Ivanhoe, another little village on the western side of the main range. The tunnel was designed to save the Colorado Midland Railway a steep climb to the summit of Hagerman Pass, and over seven miles wasted in the curves necessary to enable the engines to pull up the heavy grades. The tunnel is 9,400 feet long, and is only surpassed in this country by the famous Hoosac tunnel and the Bowlder tunnel, in Montana, the latter of which is only 300 feet longer than the Ivanhoe. Where the Ivanhoe enters the mountain at Busk, the altitude is 10,800 feet. This is a much greater altitude that that of St. Gothard, which at Goeschenen enters the ground at a height of 3,640 feet above the sea level and emerges at Airolo, on the Italian side, at a height of 3,756 feet. The road over the St. Gothard Pass is 22 miles, and the tunnel, with its length of 9¼ miles, thus saves 12¾ miles. The Ivanhoe saves much more in proportion, lessening the distance between Busk and Ivanhoe by over 7 miles in its length of less than 2 miles.

The contract for the Ivanhoe, which was let to H. F. Keefe, calls for the tunnel to be 21 feet high and 15 feet wide in the clear; and to admit of timbers, ground was broken to the extent of 22 feet 9 inches by 18 feet 6 inches. To accomplish this task, every twenty-four hours 200 pounds of giant powder and 800 feet of fuse were used. For the first 1,500 feet that were driven a good deal of trouble was encountered from water and loose rock, in many places the rock not being in place. This, at a depth of 500 to 750 feet, caused a great deal of speculation among mineralogists as to the causes which led to this disturbance. It was generally conceded that the acid in the water had cut many and diverse channels in the soft talc and granite, so separating them from the rock in place that when an opening was made from below, a chute was formed, allowing the whole mass to fall into the tunnel. For weeks at a time Mr. Keefe was kept busy removing the wreckage and patching up the cave, and was retarded in the work by the immense flow of water that usually drained out of one of the "soft spots." The flow of water amounted to 100 gallons per minute. Wherever the ground is soft it has been substantially timbered with red spruce, squaring 12×12. The ground that is in place is not closely timbered. In the work of construction the tunnel was lit by electricity, with an arc light every 80 feet, and several heavy air compressors supplied fresh ozone to the workmen at the heading. Eight air drills were kept steadily going at each approach, and the amount driven per day averaged 8 feet. From the center of the tunnel to the surface is a distance of 1,200 feet.

The present grade to Hagerman is 3 per cent, but the grade in the tunnel will be only 1·41 to every hundred feet. This stupendous undertaking was begun in August, 1890. When it is being operated by the Midland, large doors will be put up at the approaches to keep out the snow, and the tunnel for several hundred feet from each end will be heated by steam. Watchmen will be placed at the different ends to open and shut the doors before and after trains entering and leaving. Engines will be coaled up a few miles before entering the tunnel, so that the run through can be made without coaling.

## Wyoming's Soda Lakes.

As described by H. Pemberton, Jr., and George P. Tucker, there exists a deposit of sulphate of soda, locally known as a "lake," about fourteen miles southwest of Laramie, Wyo. The deposit is composed of three of these lakes lying within a stone's throw of one another—the Big Lake, the Track Lake, and the Red Lake—having together a total area of about sixty-five acres. They are the property of the Union Pacific Railroad Company, and are connected by a branch of that road with the main line at Laramie, and are generally known as the Union Pacific lakes. In these lakes the sulphate of soda occurs in two bodies or layers. The lower part, constituting the great bulk of the deposit, is a mass of crystals of a faint greenish color, mixed with a considerable amount of black, slimy mud. It is known as the "solid soda," and is said to have depth of some thirty or forty feet. Above this solid area occurs the superficial area of pure white crystallized sulphate of soda. This is formed by solution in water of the upper part of the lower body, the crystals being deposited by evaporation or by cooling, or by the two combined. A little rain in the spring and summer furnishes this water, besides which innumerable small, sluggish-flowing springs are present in all the lakes; but on account of the dry air of this region the surface is generally dry, or nearly so, and in midsummer the white clouds of efflorescent sulphate that are whirled up by the ever-blowing winds of Wyoming can be seen for miles. The layer of white sulphate is from three to twelve inches in thickness. When the crystals are removed, the part laid bare is soon replenished by a new crop.—*Popular Science Monthly.*

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### THE ELECTRIC WELDING OF RAIL JOINTS.

For many years the belief has obtained among engineers that in laying railroad tracks it is necessary to leave a certain space, about one-sixteenth of an inch, between the ends of the rails, in order to provide for expansion and contraction due to the changes of temperature. On the advent of electric welding, a very obvious application of it seemed to lie in the welding of rail joints, if the assumed trouble in regard to expansion and contraction could be got rid of. Various experiments went to show that this necessity was rather of the nature of a myth. The Johnson Company, of Johnstown, Pa., which proposed to apply electric welding to rail joints, tried an experiment to test the question. They firmly riveted, with long fish joints, fifteen hundred feet of track, so that it was practically continuous, the rivets being turned to fit the holes accurately. No trouble was experienced, the fifteen hundred feet of track not changing in any way. Other experiments have been made in the same direction, going to show that there is no danger to tracks incident to tight joints.

The electric street car companies have shown a disposition to adopt welded joints, not only to secure a continuity of track for mechanical reasons, but for electrical ones also. As the track is used for the return current, it is obvious that its conductivity should be as high as possible, and such conductivity is evidently favored by welding the joints together.

We illustrate in our present issue one form of the welding machine used by Johnson Company. It consists of a Thomson welding machine of special construction arranged to be carried on a crane projecting from a construction car. Looking at the cut, there will be seen two pivoted levers working in a vertical plane transverse to the track. Between them lies the induction coil, while above is a toggle joint operated by the large wheel in front, by which the ends of the levers can be pressed together or separated with considerable power.

In welding a joint, the current is not passed from rail to rail, but is passed transversely to the two rails. For each joint four lugs are used; these are short pieces of iron fitting pretty closely to the sides of the web of the rail, and also extending around part of its head and the upper part of its flange. When a joint is to be welded, the construction car is advanced and a small emery wheel driven by a flexible shaft is first applied to the sides of the rails in order to brighten them. The two lower lugs, resting on the lower flange of the rail and extending half way up the web, are put in position, the jaws of the electric welder are placed upon the lugs, and the current is turned on. The dark red color due to the heat appears almost instantly, and keeps brightening until a full white heat is reached. At this point one of the workmen suddenly turns the wheel, closing the toggle joints and squeezing the lugs against the sides of the rails. This not only welds them to the rails, but it is supposed to force some of the metal between the ends, so as to make a true butt joint. Gun metal clamps keep the rails in alignment during the operation. As soon as the lower lugs are welded, the upper pair are put in position, and practically fill the remaining gap, the current is passed through them, they are squeezed home when white hot, and the joint is complete.

The operation is so perfect that after the welding is done and the ground is filled to its level, it is almost impossible to tell where the weld has been completed. In closing the joints, every third joint is left unwel d in order to allow for the expansion due to the changes of temperature incident to the operation. Afterward the line is gone over a second time and the missing joints are welded. All of this is in the direction of reducing the resistance of the rails, and of so providing a better path for the return current. Whether it will do away with electrolysis or not may be considered an open question.

The process illustrated has already been successfully applied in Boston, St. Louis and Brooklyn, and bids fair to have an extensive application on trolley roads especially. The coming winter will put many miles of track to a severe test, which there is every reason to believe they will stand perfectly.

We are indebted to the *Street Railway Review* for the photograph from which our engraving was made.

THE ELECTRIC WELDING OF RAIL JOINTS.

### The Plague in China.

We have received further telegraphic information from our correspondent in Hong-Kong, from which it appears that little doubt is any longer entertained by scientific opinion in China as to the importance of the discovery by Professor Kitasato of a bacillus in the organs of those attacked by the plague. To say that Professor Kitasato is himself convinced of its specific nature is to infer that it has responded to all the tests that are essential to the diagnosis of a pathogenic micro-organism. Professor Kitasato has found the bacilli in great abundance in the bubonic swellings and in the spleens of the victims to the plague. The epidemic is stated to be on the decrease at Hong-Kong, but it is increasing at Canton.—*Lancet.*

### Great Railroads.

The Atchison, Topeka, and Sante Fe Railroad Company has 7,125 miles of line in operation; the Southern Pacific, 6,500 miles; the Chicago, Milwaukee, and St. Paul, 6,083 miles; the Louisville and Nashville, 4,700 miles; the Northern Pacific, 4,400 miles; the Chicago and Northwestern, 4,300 miles; the Chicago, Rock Island, and Pacific, 3,500 miles; the Illinois Central, 2,900 miles; the Pennsylvania, 2,500 miles; the New York Central and Hudson River, 2,100 miles; and the Baltimore and Ohio, 1,000 miles.

### Battleship Le Carnot.

The new French battleship, which was launched early in the present month, is to be called Le Carnot. The length of the vessel is 396 feet, her beam 71 feet, her draught aft 27½ feet, and her displacement 11 882 tons. She has a complete steel belt with a maximum thickness of 17·7 inches, and a curved steel deck 2·75 inches thick. Above the water line belt there rises for an additional height of 4 feet a steel belt of 4 inch armor. The machinery of the ship consists of a pair of compound vertical engines, with three cylinders, fed by twenty-four Lagrafel & D'Allest boilers. At 95 revolutions with forced draught, 13,500 horse power should be developed, giving a speed of 18 knots, and with 85 revolutions, natural draught, 9,500 horse power, giving a speed of about 17 knots. The machinery weighs 1,178 tons. The normal coal capacity is 800 tons, or enough for 4,000 knots' steaming, but when all subsidiary bunkers are full, coal for 5,000 knots can be carried. The cost of Le Carnot will be, for the ship $4,800,000, for her gun and torpedo armament $520,000, and for machinery and boilers $636,000, or in all, $5,956,000.

The armament will consist of two 11·8 inch guns, one in a 14·6 inch turret forward and the other in a similar turret aft, the forward gun being 26 feet and the after gun 19·5 feet above the water line; two 10·6 inch guns, one in a 14·6 inch turret on each beam; eight 5·5 inch quick-firing guns, mounted singly in 3·9 inch turrets, four on each beam; four 2·5 inch quick-firing, twelve 1·8 inch quick-firing, and eight 1·45 inch quick-firing or Maxim automatic guns. There will also be four above-water and two submerged torpedo-launching tubes. The most significant feature of the vessel is the enormous power of her right ahead and right astern fire. In each case this is furnished by one 11·8 inch, two 10·6 inch, and four 5·5 inch, besides smaller guns. Beam fire is furnished by two 11·8 inch, one 10·6 inch, and four 5·5 inch guns, so that in every direction the ship is offensively strong to an exceptional degree.

### Force of a Cannon Ball.

In dwelling upon the wonderful power of the guns of the Indiana, Albert Franklin Matthews, in an article on "The Evolution of a Battleship" in the *Century* for July, gives illustrations from the recent Chilean civil war, showing the effectiveness of the smaller sizes of breech-loading rifle guns.

A shot weighing 250 pounds from an 8 inch gun of Fort Valdivia, in Valparaiso harbor, struck the cruiser Blanco Encalada above the armor belt, passed through the thin steel plate on the side, went through the captain's cabin, took the pillow from under his head, dropped his head on the mattress with a thump, but without injuring a hair, passed through the open door into the mess room, where it struck the floor, and then glanced to the ceiling. Then it went through a wooden bulkhead an inch thick, into a room 25×42 feet, where 40 men were sleeping in hammocks. It killed six of them outright and wounded six others, three of whom died, after which it passed through a steel bulkhead five inches thick, and ended its course by striking a battery outside, in which it made a dent nearly two inches deep. It was filled with sand. Had it released deadly gases, no one knows what damage it might have done.

A 450 pound missile from a 10 inch gun in the same fort struck the same vessel on its 8 inch armor. It hit square on a bolt. The shell did not pierce the armor, but burst outside the vessel. It drove the bolt clear through, and in its flight the bolt struck an 8 inch gun, completely disabling it. Such is the power of the small-sized guns.

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### Increase of Fireproof Building.*

In the last twelve or fourteen years a decided change for the better in our building has occurred. This was partly brought about by the success met with by the "mill mutual" insurance companies, in what is known as mill constructed buildings, a method which was about ten years ago first introduced into the construction of the modern city warehouse. From the theory of having each floor cut off completely from other floors, it is only a step to the demand that the interior division walls, the floors themselves, and, in fact, all of the interior except the inner finish, shall be made of incombustible materials. The growth toward this demand has been slow, but it has been progressive and hence healthy. The underwriters have not been far in advance of public opinion—not so far, possibly, as they should have been; but they have been in advance, and are now doing all that they can to induce, by the advantages they offer in the way of rates of insurance premium, the owners of real estate to put up fireproof buildings, and the manufacturers and merchants to occupy these.

The practical question is, What are these inducements, and are they sufficient to lead to the construction of the fireproof type of building? I can answer this only by stating what they are and leaving it for those interested as owners and occupants of buildings to decide whether or not they are sufficient.

In the first place, it is well to point out that there was never a time in the commercial history of this country when it was so difficult for those owning property or doing business in the centers of our large cities to obtain the insurance protection which they require for safety and for the maintenance of their business credit as merchants. The number of fires in our large cities tends constantly to increase, which causes the managers of insurance companies, looking back on the numerous corporate wrecks of the past, to cut down their lines (that is the amount that they will insure on any one risk) to exceedingly small dimensions. Now this comes at a time when the requirements of business compel dealers to carry large stocks of goods and to occupy large stores. The result is that many of our merchants are running risks in the way of possible loss by fire which they do not like to think of, but which make them seriously alarmed when any fire occurs in the vicinity of their stores. Others of their number are ransacking the world for insurance protection, and failing to find enough of this in China, Australia and elsewhere, are trusting to the questionable guarantees of Lloyd and mutual associations which have been recently started in this country. Now, if these merchants occupied buildings which were recognized as distinctly fireproof—that is, buildings in which wood and other combustible substances were only used for mere purposes of finish—there is little doubt that companies which limit their lines to say $10,000 on a risk will quickly increase it to $25,000 or $30,000. In a word, the possibilities of obtaining insurance would be increased from one hundred to two hundred per cent. To the owner of a building this would sometimes mean the difference between having a tenant and not having one. The same foreign companies which limit their lines to say $10,000 on a large departmental store in an American city will write the equivalent of $100,000 on the Louvre or Bon Marché in Paris, because they know that these two establishments are carried on in strictly fireproof buildings.

And then comes the matter of rate of premium. If I am not mistaken, the rate on the Bon Marché in Paris has varied in recent years from one-quarter to three-eighths of one per cent per annum, or about one-fifth of the rate paid for insurance by such establishment as Jordan, Marsh & Co., in Boston, Macy & Co., in New York, or Wanamaker & Co., in Philadelphia. In other words, for $1,000,000 insurance, the proprietors of the Bon Marché would pay about $2,500, while the similar American establishments would pay for the same volume of insurance protection from $12,500 to $15,000. The difference in this case is chiefly in the matter of building construction. The conditions of the business are substantially alike, while the fire department of Paris can hardly be said to equal in efficiency those of our large American cities. In the opinion of the fire underwriters who insure both the Paris risks and similar risks here, there is a difference in safety in favor of the former equal to the interest that would be earned on several hundreds of thousands of dollars.

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SOME experiments made on the Brotherhood engine of a Whitehead torpedo by Mr. F. M. Leavitt, and recorded in *The Stevens Indicator*, show that the air used per brake horse power per hour varied from 61 pounds to 118 pounds. The initial pressure of the air ranged from 425 pounds to 750 pounds, and the horse power from 19 to 43. The engine had three cylinders 3⅛ inches in diameter by 2¾ inches stroke, and we believe the weight is under 40 pounds, so that 1 horse power has been attained for less than 1 pound weight of engine.

*Osborne Howes, in the *Brickbuilder*.

### Wellman's Arctic Expedition.

Authentic news has lately been received of the American North Pole expedition, known as the Wellman expedition.

The Wellman party sailed on the steamer Ragnvald Jarl from Bergen, Norway, three months ago. The steamer went to the edge of solid ice, off the coast of Spitzbergen, where the party set out over the ice in sledges for a lively sprint to the north.

Wellman had with him, among others: Professor Owen B. French, of the Coast and Goedetic Survey; Dr. Thomas B. Mohun, a surgeon; Charles C. Dodge, a constructor in the United States navy, and a party of scientific graduates of the University of Christiania.

August 2, the fishing vessel Malygen arrived at Tromso from North Spitzbergen with Captain Bottolfsen and three seamen of Wellman's steamer Ragnvald Jarl.

They report that, after several struggles in the ice, the Ragnvald Jarl arrived on May 12 at Table Isle, one of the Seven Islands, situated off the northeast coast of Spitzbergen, in latitude between 80° and 81° and east longitude between 20° and 21°. The ice compelled the party to return to Walden Isle.

On May 24 Wellman set out with thirteen men, forty dogs, and provisions for 110 days. May 28 the steamer Ragnvald Jarl was crushed by ice and was totally lost. Only some stores were saved. A message concerning the disaster was sent to Wellman, and it reached him on Martens Island, near Seven Islands.

Wellman, Dodge, and two others returned to Walden Island. They built there a solid house of the wreckage. The house accommodated the majority of the crew, and would afford ample shelter to the explorers should they be compelled to winter on Walden Island.

Wellman departed on May 31 for Martens Island. The last news from him was received on June 17, when Winship and another left the expedition six miles east of Platen Isle, which is not far from Seven Islands. There the party had come upon an impassable ice field. Wellman was waiting for the opening and all were well.

Upon Winship's return to Walden Island, Bottolfsen and some others journeyed southward in aluminum boats, hoping to meet fishing vessels. Thus they met the Malygen.

A new vessel will be chartered to bring back the expedition. Meanwhile Wellman and his companions are crossing the ice, probably in the direction of Gilleiland.

The ice conditions in the early part of the expedition were exceptionally unfavorable. Trygve Heyerdahl, the young philosophical student who accompanied the expedition, has gone to Danes Island to join Peter Oyen, the geologist.

### Inclined Plane Railways of Cincinnati.

The operation of inclined planes forms a very important part of the street railway system of Cincinnati. The business portion of the city is located on a plateau, which rises abruptly from the river to an average elevation of about seventy-five feet, and which is backed by an irregular line of bluffs, having an average altitude of from 300 to 350 feet above the river, over and beyond which the city has already spread.

The principal hills are named respectively Price Hill, Mt. Adams and Walnut Hills. Walnut Hills is on the north and extends almost to the bank of the river. The heights are all reached by inclined planes, cable roads, and, in some instances, by the electric lines, so that the rapid transit facilities of the city embrace almost every known method of traction, including horse car lines, cable and electric roads, inclined planes and one dummy line. There are four inclined planes, on three of which the electric cars are transferred from one level to the other and continue their course. The planes are provided with triangular shaped trucks, with platforms on the level, so that the electric cars are readily run on or off at the terminals. All the inclines are provided with the latest types of safety devices, and are operated in a very safe and satisfactory manner.

The Price Hill incline is designed for both passenger and freight traffic. The two lines are located near to each other, but are operated from separate stations. The passenger traffic is transferred from the street cars to the cab of the incline, and at the top of the hill a second transfer is made to connect with the lines on the upper plane. The freight section is designed for vehicle traffic, and the cars are capable of taking three or four heavily loaded wagons with teams at a trip. This is the only one of the Cincinnati inclines that has not been before described in these columns. The tracks are 800 ft. in length, and are laid on an average of 44·6 per cent, making a total rise of 350 ft. During the morning and evening hours, or when traffic is heavy, trips are made every three minutes. The incline carried about 1,000,000 passengers in 1893. The fare is five cents, except where the trip is to be continued, when five cents includes the street car fare into the city. On the other line the round trip for ordinary vehicles is twenty-five cents, and for heavily loaded trucks eighty-five cents.

The freight incline is operated by a 200 horse power poppet valve, duplicate engine, manufactured by Frisbie, of Cincinnati. The winding drums are thirteen feet in diameter. The passenger engines are 100 horse power, manufactured by John Cooper & Company, Mt. Vernon, O. They have been in service since 1875, and are still in good condition. The power station is located at the top of the incline, and adjoining it is a park and summer garden, well shaded and provided with rustic seats, and with a railing along the edge of the bluff. From this location one of the most interesting views is had of the city and surroundings. All the bridges which cross the river, also Covington and Newport, are embraced in the outlook.—*Street Railway Journal.*

### Spraying Solution for Elm Trees.

In some parts of the country during the past spring and summer months the ravages of the elm tree worms in destroying the fine foliage of these grand trees have been terrific, until now large numbers of trees are bereft of foliage.

In Central Park, New York, the trees have also been attacked, but, by special care in spraying, the park entomologist, Professor E. B. Southwick, has preserved them to a remarkable extent.

He sprays the foliage of the tree early in the season with the following solution:

| | |
|---|---|
| London purple | ⅜ of an ounce. |
| Flour | 1 teacupful. |
| Water | 1 pail. |

Thoroughly mix and spray on the trees.

In August the larvæ are coming down the trees and will turn into the beetle state; they will be found in quantities at the base of the tree. These should be sprayed with an emulsion made of

| | |
|---|---|
| Soap | 1 pound. |
| Kerosene oil | ½ a pint. |
| Crude carbolic acid | ½ a pint. |

Mix in four quarts of hot water into an emulsion, which can be then diluted with six pails of water and be used as a spray. It is important also that the apparently inert pupæ at the base of the tree be sprayed in the same way, as it will help materially in lightening next year's work.

### Something for Strikers to Remember.

General Army Orders No. 23, issued July 9, 1894, contains, among other things, the following:

A mob, forcibly resisting or obstructing the execution of the laws of the United States, or attempting to destroy property belonging to or under the protection of the United States, is a public enemy.

Troops called into action against such a mob are governed by the general regulations of the army and military tactics in respect to the manner in which they shall act to accomplish the desired end. It is purely a tactical question in what manner they shall use the weapons with which they are armed—whether by the fire of musketry and artillery or by use of the bayonet and saber, or by both, and at what stage of the operations each or either mode of attack shall be employed.

As a general rule the bayonet alone should be used against mixed crowds in the first stages of a revolt. But, as soon as sufficient warning has been given to enable the innocent to separate themselves from the guilty, the action of the troops should be governed solely by the tactical considerations involved in the duty they are ordered to perform. They are not called upon to consider how great may be the losses inflicted upon the public enemy, except to make their blows so effective as to promptly suppress all resistance to lawful authority, and to stop the destruction of life the moment lawless resistance has ceased. Punishment belongs not to the troops, but to the courts of justice.

### A Carpet Tack Causes a Disastrous Fire.

On August 2 a tack dropped in a picker machine caused a $70.000 fire in the four-story mill at Randolph and Jefferson Streets, Philadelphia, occupied by McCloskey & O'Hara, carpet cleaning works, and John A. Cronin & Co., yarn spinners, and two firemen were killed and seven injured by a falling floor.

About 4:45 P.M. a tack dropped into the machine at which an operative of Cronin & Co.'s was at work on the third floor.

The sparks flew into the inflammable yarn and started a blaze that rapidly spread through the room. There were about forty men and women at work in the carpet cleaning works.

### A Spark from a Horse's Shoe Causes a Gas Explosion.

A gas main running near a drinking fountain at Montclair, N. J., recently became broken, and gas escaped in large quantities. Word was sent to the gas company, and as soon as the notice was received men were sent to repair, but before their arrival the explosion occurred. The base of the fountain was badly wrecked and the sidewalk torn up. It was said that the escaping gas ignited from a spark from a passing horse's shoe.

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## RECENTLY PATENTED INVENTIONS.

### Engineering.

BLOWER.—Charles Rumley, Helena, Mont. This is a blower of durable and inexpensive construction, adapted to pump air into mines and other places, or for exhausting foul air and gases therefrom. A crank shaft is mounted in a case having inlet ports in its ends and a discharge port in one side, while a cylindrical piston on the crank of the shaft is adapted to close the inlet ports, and a valve, having one end pivoted to the case and the other to the piston, is adapted to swing across and close the discharge ports. There are but few parts to this blower, and it is not likely to get out of order.

SHIP.—Alberte Foerste, Berlin, Germany. This inventor designs to give such shape to the hulls of vessels that great velocity can be obtained on a shallow draught, with the minimum of frictional resistance, permitting also of the use of strong armor plates without considerable increase of the draught. The hull, below the water line, has a reduced and tapering portion, provided with air boxes projecting downward on opposite sides, and forming longitudinal passages narrower at the bow than at the stern, rendering the capsizing of the vessel an impossibility, and protecting the paddle wheels from projectiles.

ROPE LAYING FOR LOG PULLING.—Edmund M. Ivens, New Orleans, La. This invention relates to another patented invention of the same inventor for an apparatus adapted to pull heavy cypress logs from swamp lands or brush, where the winding drums receive a mile or more of large wire cable, with which is connected a mile or more of messenger or loop section. The apparatus provides independently operated winding drums, with suitably arranged rope laying or leading devices, whereby the drums may be instantly reversed as desired.

### Railway Appliances.

SWITCH OPERATING DEVICE.—Harry H. McKee, Brooklyn, N. Y. This is an improvement on a formerly patented invention of the same inventor, rendering the application of the device more positive and simplifying the construction. The device is especially designed for use in connection with street railway cars, and provides for so locating the operating arms, or that portion which must appear at the surface of the roadbed, that these portions will be adequately protected, and the boxing need not rise appreciably above the roadbed.

REFRIGERATOR CAR.—Ferdinand E. Canda, New York City. This invention provides improved means for securing the insulating material in the walls of a car, to prevent it from becoming crumpled or being jarred from its fastenings. The car walls are also made light, thin and inexpensive. The insulating frames or panels have on one of their sides a marginally protruding layer or facing of insulating material, the panels being clamped between the posts, braces, or sills of the car frame. A reliable tight joint is made between the insulating material and the car frame.

CAR SEAL.—Benjamin J. Sturtevant, St. Paul, Minn. This invention consists of a tag made of breakable material, and formed with a recess into which opens a slot, a spring hook being adapted to be drawn into the recess and having at one end an extension to fill the slot. The device effectually prevents unauthorized persons from tampering with the hook in the hollow tag to open the seal.

### Mechanical.

LIFTING MACHINE.—David Nelson, Reno, Nev. This is a machine which may be employed as a jack or otherwise, having great purchasing power, with simplicity and quickness of operation. It is designed to facilitate the lifting of a bar or other object in the direction of either end through applied eccentrics and loose dogs, the gripping dogs engaging equally on opposite sides.

### Agricultural.

DISK HARROW.—John C. Bauer and John P. Feyereisen, Remsen, Iowa. These inventors have made an improvement in machines employing gangs of rotary disks running on the ground and breaking up the clods, employing therefor a set of small disks with suitable supports to hold them against the larger disks to scour and clean the latter of the adhering earth. The action of the pulverizing disks is thus made more effective and the draught of the team lightened.

PLANTER.—Caleb E. P. Hobart, Cherokee, Iowa. This is a machine especially adapted for planting corn, combining in one implement a planter and a drill. The machine obviates the necessity for cross markers or measuring chains, the seed droppers being located in such manner that they will themselves enable a field, whether large or small, to be planted in perfect squares.

PEACH SCREEN.—John P. Wilson, Hamburg, N. J. For sorting and screening peaches and accurately grading them in various sizes, this inventor has devised a cheap and simple apparatus, which may also be applied for other purposes It consists of an inclined bed with transverse slots and laterally inclined spouts, there being removable rails in detachable sections above the bed, and removable partitions above the meeting ends of the rail section.

### Miscellaneous.

MEASURING FORCE OF PROJECTILES.—Heinrich Brunswig, Troisdorf, Germany. To accurately measure the penetrative force of projectiles this inventor provides an apparatus consisting of a tank holding water, with a head formed of a jelly or soft glutinous substance, to retain the water and at the same time permit the projectile to readily pass into the tank. Within the tank is a tray with perforated bottom and transverse partitions forming compartments in which the projectiles drop.

COAL, GRAVEL, AND ORE SCREEN.—George W. Cross, Pittston, Pa. This is an improvement on a formerly patented invention of the same inventor, and consists of a metal screen having an integral web portion with rectangular interstices, the two parallel sides of one interstice being the one concave and the other convex with relation to the working face, and the interstices of one row being opposite to the connecting bars or webs of the adjacent rows.

PREVENTING CREASING OF FABRICS.—Albert Hox, Crefeld, Germany. To prevent creases in heavy plushes and velvets this inventor has devised a box in which the opposite sides have fabric-engaging cramps or arms, the two ends of the box being hinged to fold down, whereby the fabric will be held under a slight tension to prevent sagging and imposing weight on the folds beneath, thereby preventing creasing and preserving the perfect condition of the fabric.

SHOE FASTENING.—Chaskel C. Eisenberg, Stettin, Germany. This fastening consists of a draught band having a series of clips movable on suitable guides along the edges of the parts to be fastened, the clips varying from each other and the band having devices corresponding to the clips for engaging each its corresponding clip, the devices successively moving the clips in one direction for fastening the parts, and collecting them when moved in the opposite direction. The invention is also applicable to various other articles of dress and personal wear.

LACE FASTENER.—Edwin A. Pumyea, Jersey City, N. J. This is a novel and simple attachment for a shoe or glove, to retain the end portions of lacing cords, and permit their quick and easy release. It consists of two perforated sheet metal pieces, each having one convex face, one piece having coniform projections at its corners and a depending tang at each end, while a securing shank is passed through the perforations of both pieces and through the article on which the device is applied.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.


## SCIENTIFIC AMERICAN BUILDING EDITION.

**AUGUST, 1894.—(No. 106.)**

TABLE OF CONTENTS.

1. An elegant plate in colors showing a residence at Plainfield, N. J., recently erected for George H. Babcock, Esq. Perspective views and floor plans. A picturesque design. Mr. E. L. Hyde, architect, New York City.
2. A residence at Edgewater, Ill., recently erected for Mrs. Eva L. Prescott. Perspective elevations and plate in colors, together with floor plans. An excellent design. M. J. L. Silsbee, architect, Chicago, Ill.
3. A residence recently completed for J. P. Clarendon, Esq., at Hackensack, N. J. Two perspective elevations and floor plans. Mr. J. E. Turhune, architect, Hackensack, N. J. An attractive design.
4. A dwelling at Erie, Pa., erected for William J. Sell, Esq., at a cost of $4,500 complete. Two perspective elevations and floor plans. Mr. C. F. Dean, architect, Erie, Pa.
5. A beautiful residence recently erected at Belle Haven, Conn. Three perspective elevations, one interior view, together with floor and ground plans. Mr. C. P. H. Gilbert, architect, New York City. A model design.
6. The beautiful residence of E. Einstin, Esq., at Pompton, N. J. Perspective elevation and floor plans. Cost complete about $20,000. Architect, Mr. Manly N. Cutter, New York City.
7. A conveniently and economically arranged suburban cottage recently erected for George W. Payne, Esq., at Carthage, Ill. An attractive and picturesque design. Perspective elevation and floor plans. Cost $3,000 complete. Architects, Messrs. G. W. Payne & Son, Carthage, Ill.
8. Perspective elevation and floor plans of a well arranged dwelling, recently erected for A. N. O'Harra, Esq., at Carthage, Ill. A pleasing design. Cost complete, $5,500. Architects, Messrs. G. W. Payne & Son, Carthage, Ill.
9. A stable at Belle Haven, Conn. Perspective view and ground plan. A unique design. Mr. C. P. H. Gilbert, architect, New York City.
10. The Club House of the Knickerbocker Field Club, recently erected at Flatbush, L. I., N. Y. Engravings and floor plans. Messrs. Parsett Bros., architects, Brooklyn, N. Y. A neat design in the Colonial style.
11. An elegant residence of A. B. Bigelow, Esq., at Cranford, N. J. Perspective elevation and floor plans. Estimated cost, $6,000. Mr. Manly N. Cutter, architect, New York City.
12. Miscellaneous Contents: The Hayes metallic lathing, illustrated.—Nonsuch Palace.—The Joseph Dixon Crucible Co.—The slate business.—New and old styles of eaves troughs. illustrated.—The Weathered hot water heaters.—Design for mantel and fireplace, illustrated.—The "P. & B." sheathing and insulating papers.—An improved vise, illustrated.—What becomes of all the lumber.—Globe ventilator, illustrated.—An improved sadiron, illustrated.

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## Notes & Queries

### HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
**References** to former articles or answers should give date of paper and page or number of question.
**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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**Books** referred to promptly supplied on receipt of price.
**Minerals** sent for examination should be distinctly marked or labeled.

(6176) R. J. L. asks how to make peach ratafia. A. Ratafia, for flavoring, is by no means difficult to make when the peach is in season. The following is a simple recipe: Blanch 2 ounces of peach or apricot kernels; bruise them well; put them into a bottle, and fill it nearly up with good brandy; dissolve in a cup of cold water ½ pound of white sugar candy, and add it to the brandy after it has stood for a month on the kernels; strain off the kernels before you add the sugar; then filter through paper, and bottle off in small bottles for use. Another rather more expensive method of making it is to take 50 bruised peach kernels, ¼ pound of bitter almonds, 1 pound of white sugar candy, and mix thoroughly with 1½ pint of 90 per cent alcohol, then add 3 quarts of water and 1½ gallons of malt spirits.

(6177) W. B. W. says: I have a tent that is made from ordinary canvas that I wish to render waterproof; kindly inform me what preparation I shall use. A. The following is a simple and cheap process for coating canvas for wagon tops, tents, awnings, etc. It renders it impermeable to moisture, without making it stiff and likely to break. Soft soap is dissolved in hot water, and a solution of iron sulphate added. The sulphuric acid combines with the potash of the soap, and the iron oxide is precipitated with the fatty acid as insoluble iron soap. This is washed and dried, and mixed with linseed oil. The soap prevents the oil from getting hard and cracking, and at the same time water has no effect on it.

(6178) W. R. says: A man can walk 33 miles in a day and be very much fatigued at night. The same man, if he be an expert, can on a bicycle run 100 miles in same time. Where does the extra power come from which increases his speed three times? In the last case he carries his own weight and the additional weight of the bicycle. A. The ways and means of converting power into speed through mechanical devices do not show that extra power is developed through such contrivances. In fact, there is probably far greater muscular power expended in running a bicycle 100 miles in 10 hours than in walking 33 miles in the same time. The method of applying power for any special purpose is a form of conservation of force for the best results, and when applied for speed alone is wonderfully illustrated in the various ways of attaining it in animals designed for speed and in the flight of birds. Man was not built in nature for speed, but by his genius converts his strength into speed on the best mechanical principles.

(6179) F. E. L. asks how to make a good paste for mounting photographs.

A. Best Bermuda arrowroot..... 1¾ oz.
Sheet gelatine or best Russian glue.....80 grn.
Water.....15 oz.
Methylated spirit..... 1 oz.

Put the arrowroot into a small pan, add 1 ounce water and mix it thoroughly up with a spoon, or the ordinary mounting brush, until it is like thick cream, then add 14 ounces water and the gelatine broken into small fragments. Boil for four or five minutes, set it aside until partially cold, then add the methylated spirit and six drops of pure carbolic acid. Be very particular to add the spirit in a gentle stream, stirring rapidly all the time. Keep it in a corked stock bottle and take out as much as may be required for the time and work it up nicely with the brush. A number of additional formulas will be found in "The Scientific American Cyclopedia of Receipts, Notes and Queries," from which the above formula was taken.

(6180) C. E. W. says: 1. Will you please suggest some way to kill or stop the red and black ants from entering our pantry? A. Put borax around the cracks of the floors, shelves, etc. 2. Will you please give me the formula used by botanists to preserve the color of flowers to be mounted in an herbarium? A. Dust salicylic acid on the plants as they lie in the press, and remove it again with a brush when the flowers are dry. 3. A way to color a piece of hardened steel blue otherwise than by heat. A. Blue finish without heat.—Clean every part carefully, and apply nitric acid 1 part diluted with 10 parts of water until a blue film is produced on the surface. Then wash with warm water, dry, and wipe with linseed oil.

(6181) Reader says: Our village has a system of waterworks on the gravity system. It is a tank holding 1,400 barrels, 14 feet high, staves, and built on posts 50 feet high. The tank is built on a hill 25 feet high, which gives an elevation altogether of 90 feet when the tank is full; 1000 feet from the tank at the bottom of the hill a water gauge shows a pressure of 45 pounds when the water is not running. Now, what we would like to know is this? How long will it take to empty the tank through a one inch nozzle 1,000 feet from the tank at the bottom of the hill, where the pressure is 45 pounds (still pressure)? A. In the absence of detailed statement as to size of pipe and its windings in the village distribution to any nozzle, which we assume to be fire nozzle of good form, we can only approximate the time of emptying the tank to be four and a half hours.

(6182) G. W. M. says: Will you please inform a reader of the SCIENTIFIC AMERICAN through query column of same of a substance to remove yellow stains from linen caused by iron rust? A. By adding 2 parts cream of tartar to 1 part oxalic acid ground fine and kept dry in a bottle you will find, by applying a little of the powder to rust stains while the article is wet, that the result is much quicker and better. Wash out in clear warm water to prevent injury to the goods.


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## INDEX OF INVENTIONS

**For which Letters Patent of the United States were Granted**

**July 31, 1894,**

**AND EACH BEARING THAT DATE.**

[See note at end of list about copies of these patents.]

| | |
|---|---|
| Accordion, zither, T. J. Muller | 523,902 |
| Air compressor, double-acting hydraulic, J. H. Champ | 523,830 |
| Ammonia, making, L. Sternberg | 523,819 |
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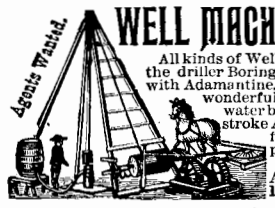

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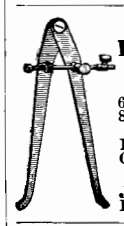
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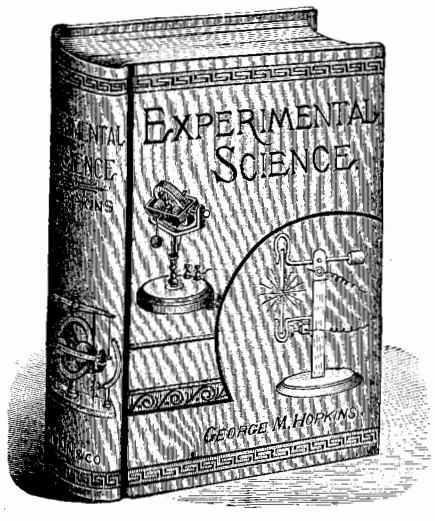

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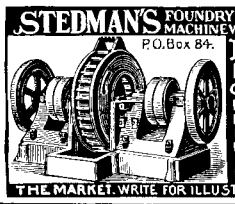

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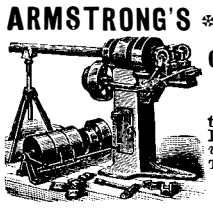

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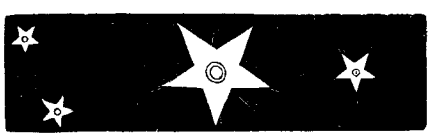

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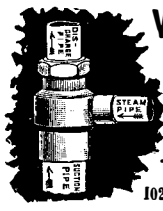

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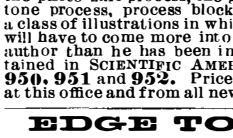

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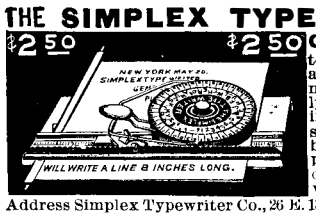


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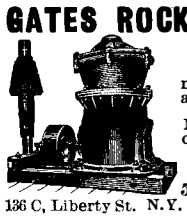

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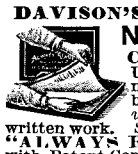

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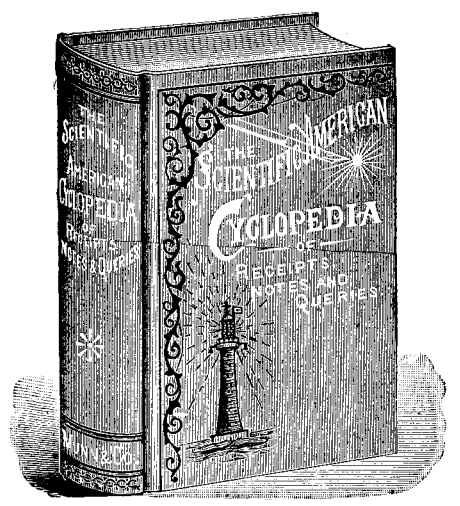


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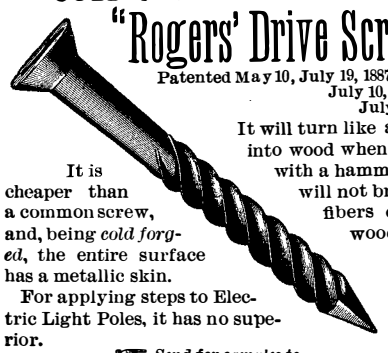

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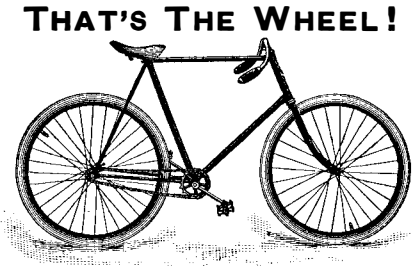

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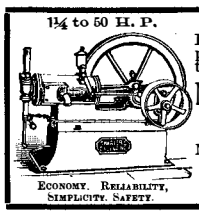

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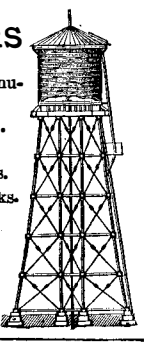

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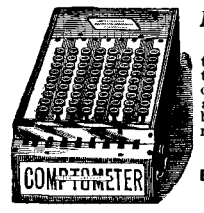


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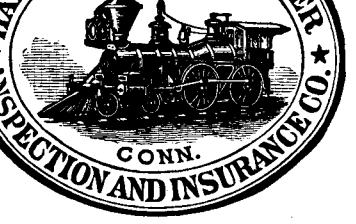

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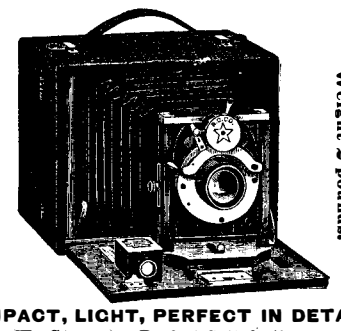

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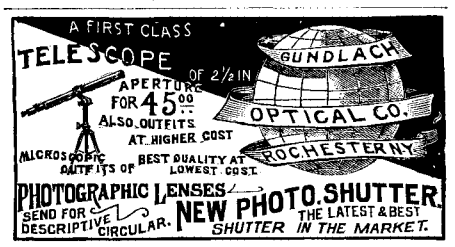
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